

4/24/79

NOTES ON 101280

ADJUST TRIP POINTS

AT 60 HZ - SET

ABOUT $\frac{1}{2}$ V LOW AT
AND 103.0

161.5 AND 131.0

400 HZ TRIP POINTS ARE
ABOUT 1 VOLT HIGHER
THAN 60 HZ

101280

(OLD)

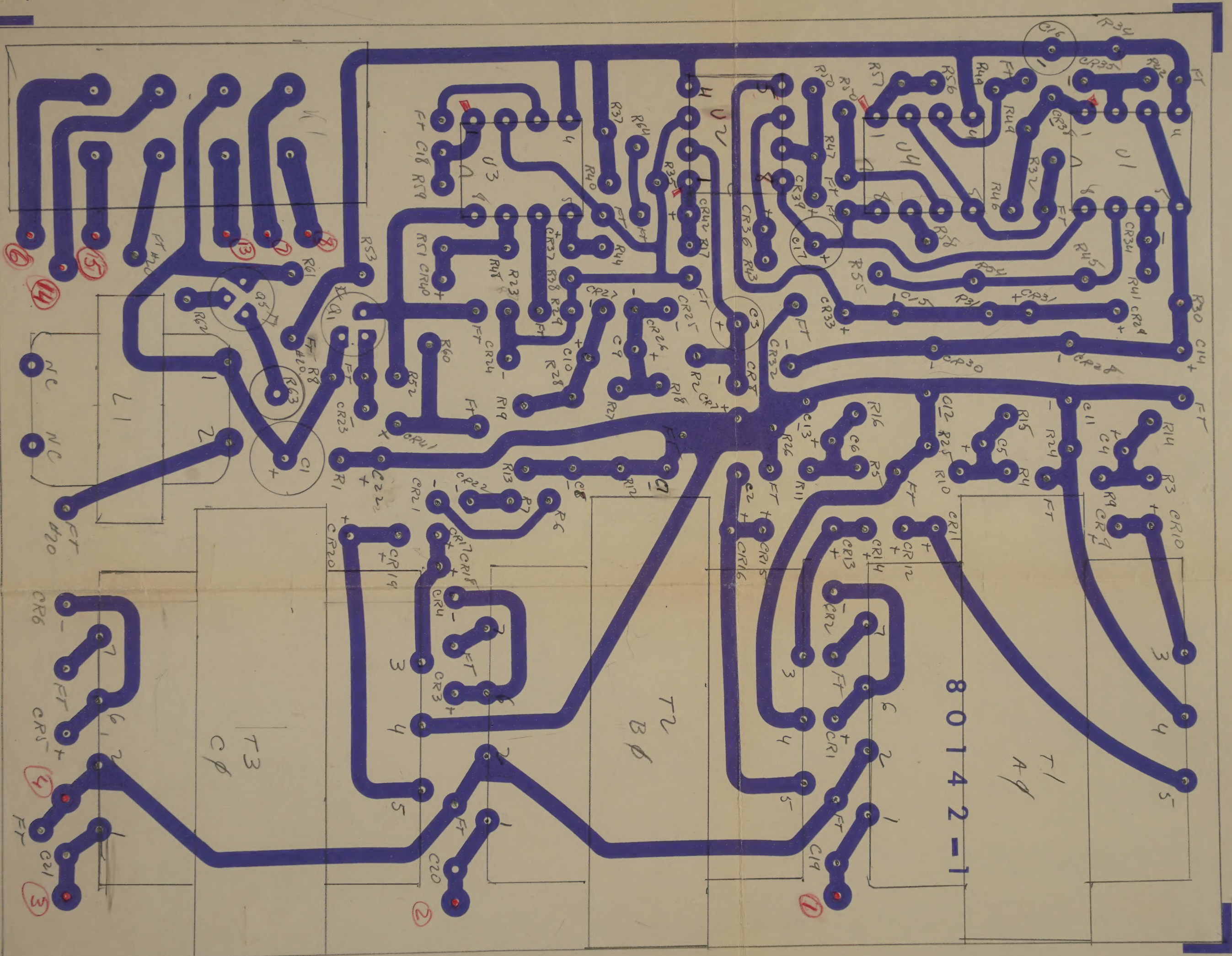
ADJUST TRIP
POINTS AT

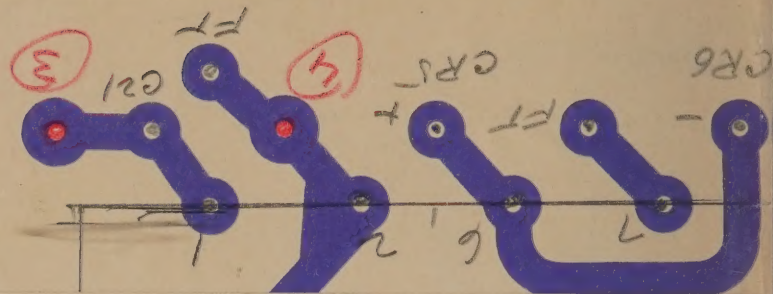
400 HB -

SET TRIP POINTS
TOWARDS UPPER
END

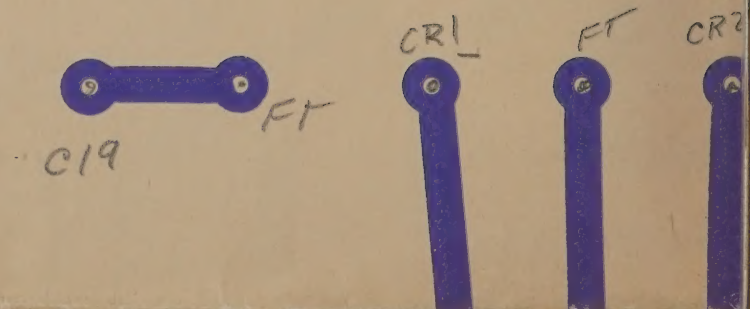
101280

nov/22/77

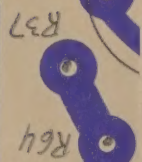
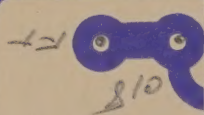




8 0 1 4 2 - 2



121



101280

5785 = X FORMER

400 Hz ONLY

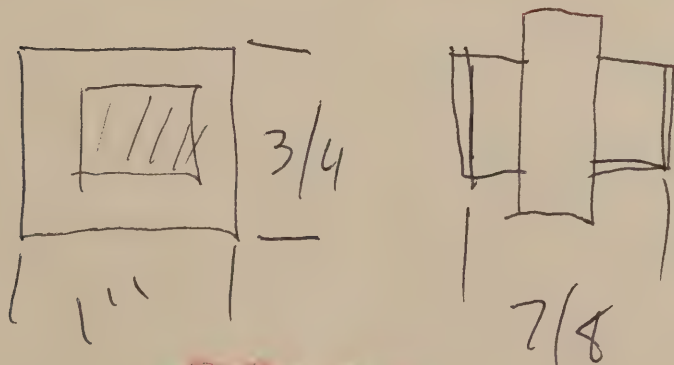
$\frac{3}{4}$ X 1" MAYBE

~~AMPERE~~

5759 COIL -

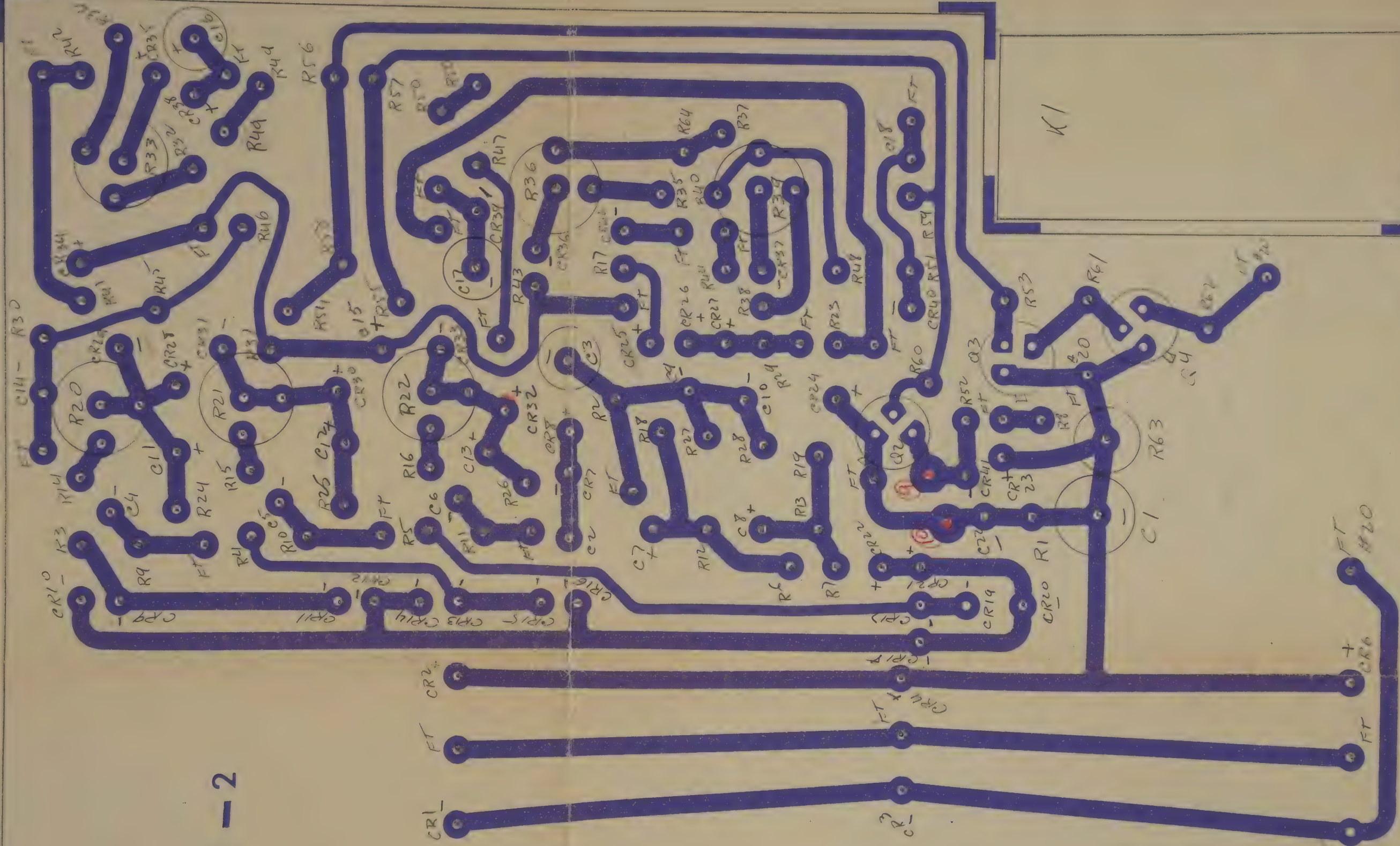
400 Hz - SAME

• 8 X 9. 22.5 V 15 MA
8 MA



5922

80142-2



101280

5785 = X FORMER

400 Hz ONLY

$\frac{3}{4}$ X 1" MAY 13/81

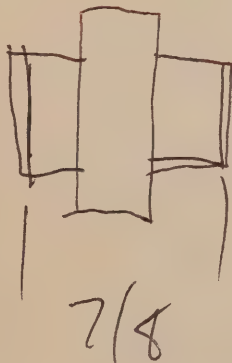
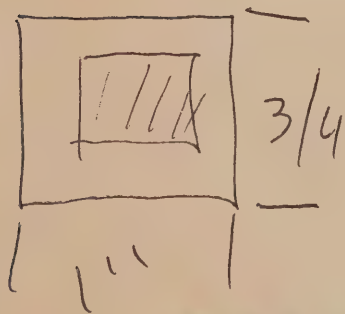
~~AMPERE~~

5759 coil -

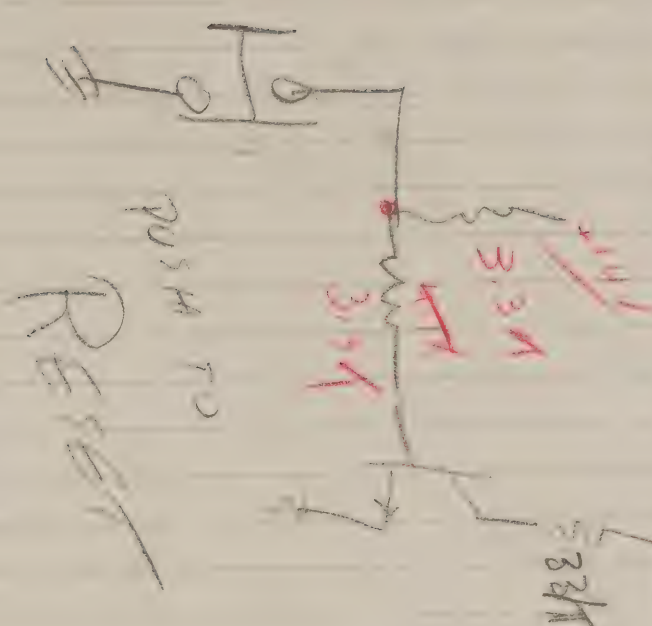
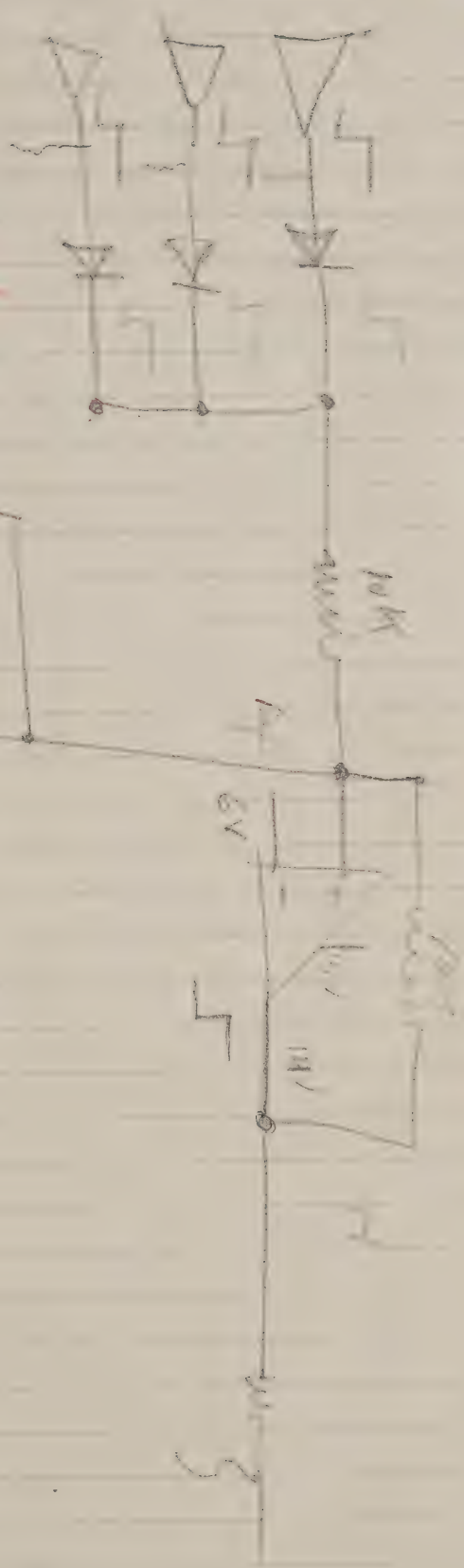
400 Hz - SAME

• 8 X 9.

22.5 ✓ 15 MA
= XX 6 MA

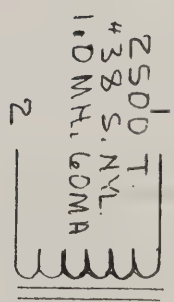
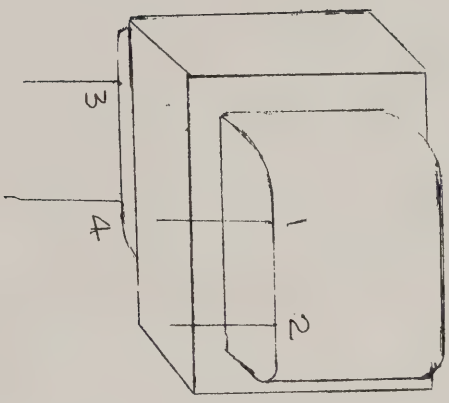


5922



CAPACITANCE
 CAN'T RESET THE
 POWER SUPPLY

20.1
 20.1



• 4
NO. CONNECTIONS
• 3

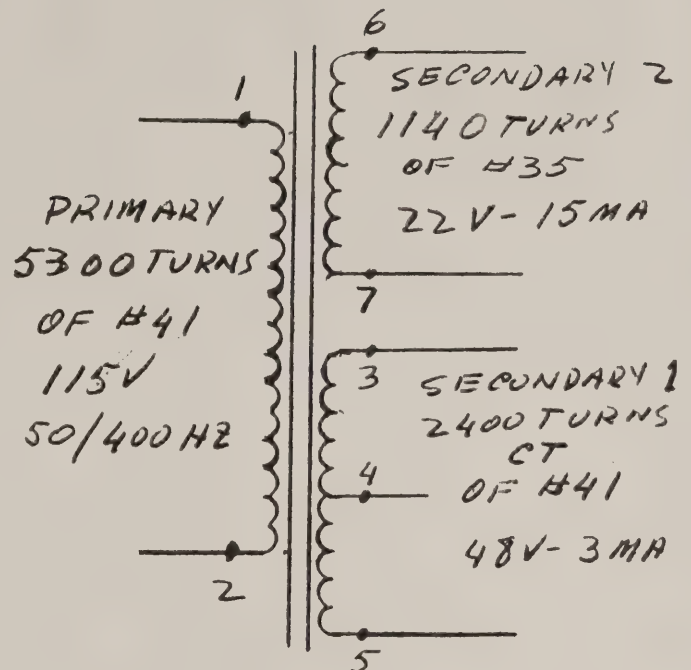
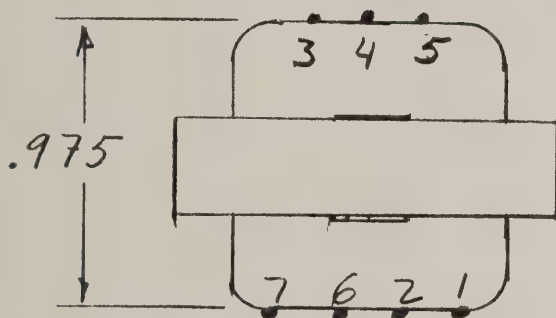
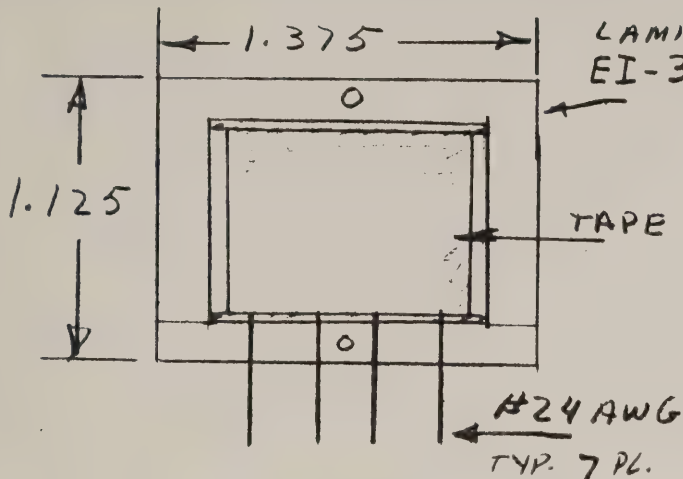
6	AR	INSULATING TAPE
5	AR	VARNISH
4	4	# 24 T.C. BUSS WIRE
3		EE-186-187 .006 GA. MG LAMINATION
2	1	ROBRIN 3/16 X 3/16 NY-5 T-41
1	AR	# 38 SINGLE NYLEEZE
ITEM	QTY	DESCRIPTION

ALLKOR TRANSFORMER

DATE	DRAWN BY	APPROVED BY
SCALE	REVISED	

INDUCTOR 1 M H 60 MA DC

DRAWING NUMBER
5759



ISOLATION:
PRIMARY TO SECONDARIES
500 V RMS
100 M. AT 500 VDC

3. TOP DWG: 101280

2. MANUFACTURER:

ALLKOR TRANSFORMER
SANTA ANA, CA.

P/N- 5785

1. WRAP WITH ELECTRICAL
TAPE AND VACUUM
VARNISH IMPREGNATE.

#41	WIRE-SINGLE NYLON EZE
#35	WIRE-SINGLE NYLON EZE
#24	BUSS WIRE - 3 1/4 LONG (7)
EI-375	29G-M6-CORE LAMINATIONS
T-109	BOBIN - TIMCO
PART NO.	DESCRIPTION

NOTES:

DIMENSIONS ARE
IN INCHES AND
AFTER PLATING

TOLERANCES
(unless otherwise
specified)

.X ±.1

.XX ±.03

.XXX ±.010

ANGLES ±0.5°

MACH
SURF



DR *Cons. 6/10/86*
CHK
DSGN
PROJ
REL

APPROVED

APPROVED

DO NOT SCALE DRAWING

Parko

ELECTRONICS COMPANY INC., SANTA ANA, CALIF.

POWER TRANSFORMER
115V-50/400 HZ - .500 WATTS

CODE IDENT NO.

13979

SIZE

A

REV

60067

SCALE NONE

SHEET 1 OF 1

60067

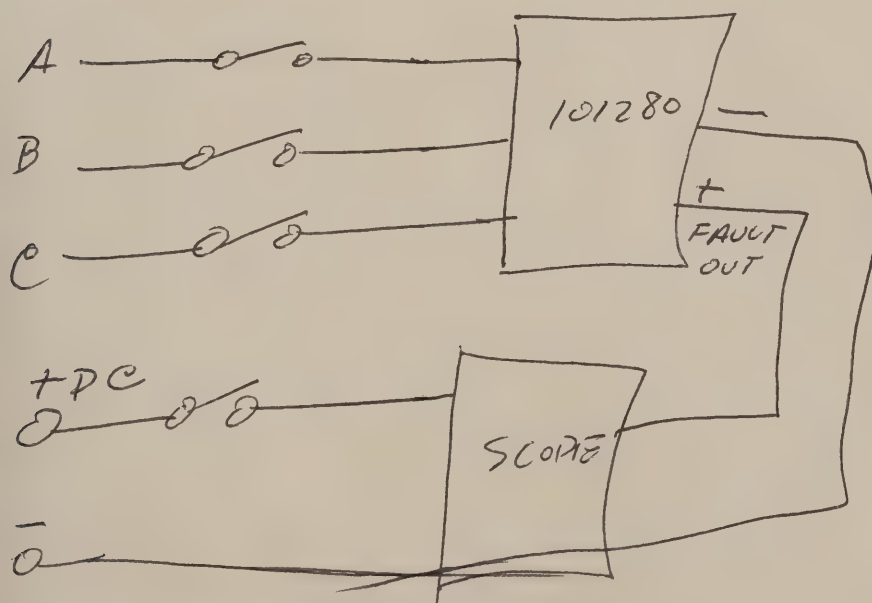
TRANSFORMER (P/N 101280)

5785



TO CHECK HI-SPEED
FAULT OUTPUT USE A
4 POLE SWITCH.

3 POLES TO SWITCH
PHASES A, B, C AND
1 POLE TO TRIGGER
SCOPE.



ADD 4 CAP.

CHANGE

GND FOR

C14-R30

CHANGE GND

FOR ALL 3

SENSING SECT.

CHANGE

R37, R48

101280

RECORD OF UNITS MODIFIED OR
BUILT WITH THE MODIFICATION TO
ELIMINATE FALSE RELAY DROP OUT WITH
LOW LINE VOLTAGE TRANSIENTS.

5/27/77 - WAS: 3271A0071576
IS: 3271A0072177

THIS UNIT WAS PROVIDED BY J. EKEROIAN
WITHOUT TEST WORK TO TRY THE MOD. IT WAS
SENT BACK TO HIM FOR APPROVAL.

6/14/77 - WAS: 3129A0032575
IS: 3129A0032377
WAS: 3271A0051576
(IS: 3271A0052377) ✓ → THIS UNIT CAME BACK WITH
AIS: 3271A0050578 HEADER PINS BURNED AT

6/9/77 - TWO NEW UNITS
3453A0012977
3453A0022977 ✓

11/10/77 - 3271A0104577
3271A0114577

12/2/77 - WAS - 3271A0021576
IS - 3271A0024977
WAS - 3271A0031576
IS - 3271A0034977

1/30/78 - WAS - 2077A0032675
IS - 2077A0030578

4/5/78 - WAS - 3271A0011576 IS 327A0011478
" 3271A0041576 IS 327A0041478

6/26/78 WAS - 3271A0081576 IS 3271A0082678

6/18/78 WAS - 3110A0012376 IS 3110A0012579

101280

JAN-22-82

TIRIP POINTS

FREQ.

A B C 3 ϕ PAR.

60 Hz - 131.0 - 131.0 - 131.0 - 129.5 - 130.2
50 Hz - 131.1 - 131.1 - 131.0 - 129.7 - 130.4

60 - 103.0 - 103.3 - 103.0 - 105.5 - 106.3
50 - 102.9 - 103.4 - 102.9 - 105.6 - 106.5

TIMING

60 - 2.04 S. - 125MS - 4.90S. - 8MS
50 - 2.05 S. - 175MS - 4.98 - 10MS

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
-	SEE SHEET 11		

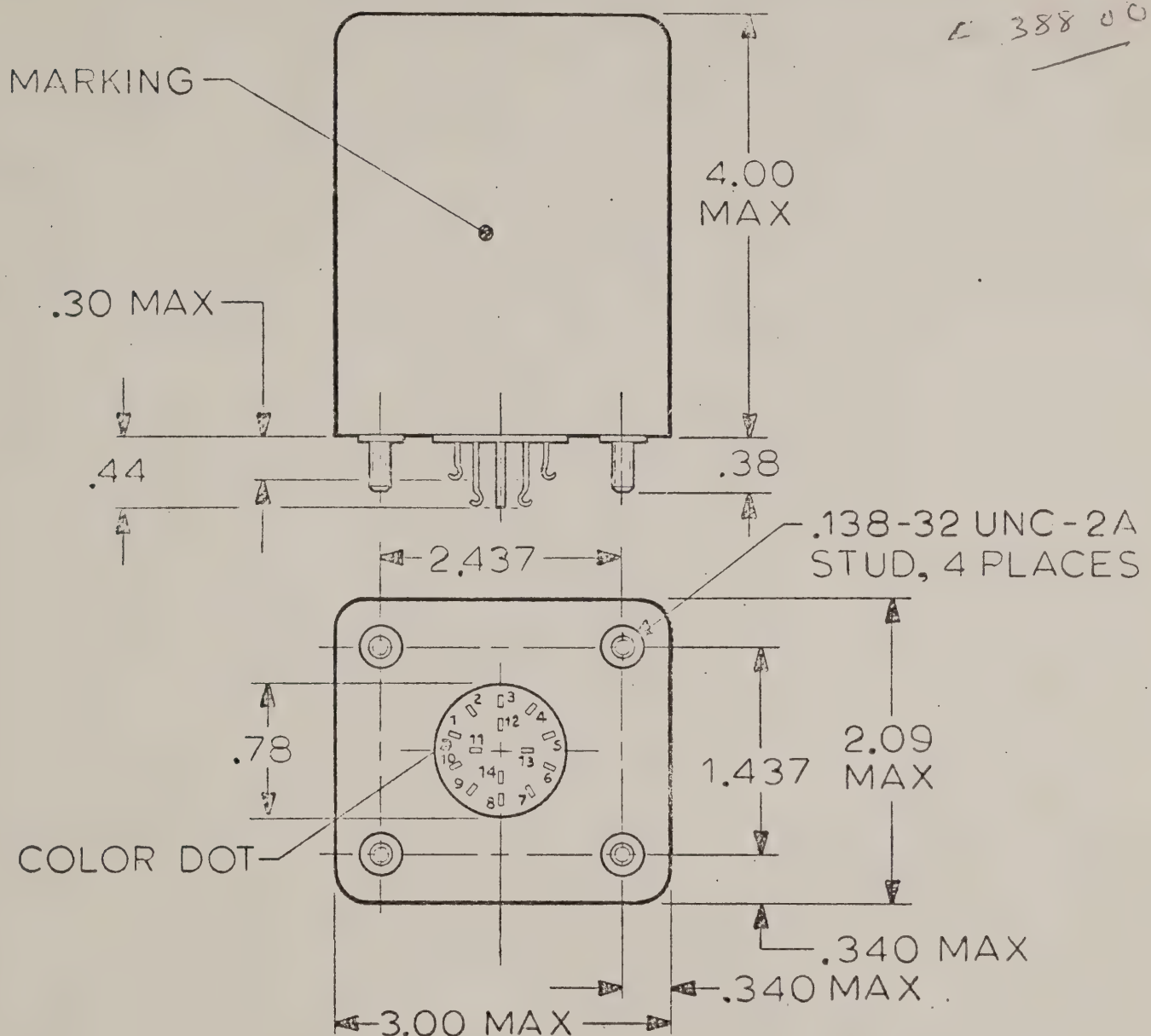
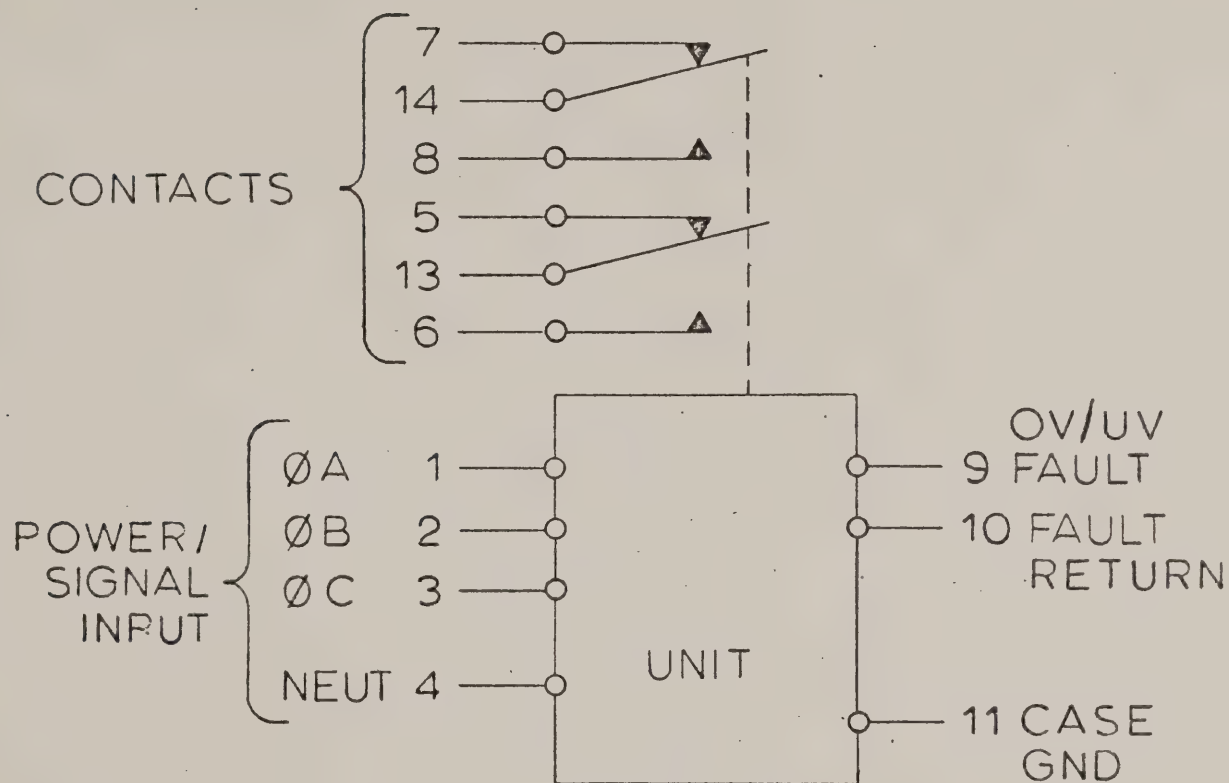


FIGURE 1: PHYSICAL DIMENSIONS
SPECIFICATION CONTROL DRAWING

PREPARED IN ACCORDANCE WITH MIL-STD-100A

INTERPRET DRAWING IN ACCORDANCE WITH MIL-D-1000, CATEGORY F, FORM 1

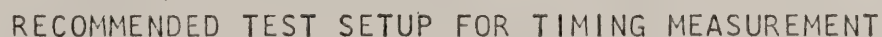
EXCEPT AS NOTED DIM. ARE IN INCHES AND PER ANS Y14.5 .XXX .XX ANGLES +.010 +.03 -		<div style="border: 1px dashed black; padding: 2px; display: inline-block;">HUGHES</div> HUGHES AIRCRAFT COMPANY FULLERTON, CALIFORNIA	
MATERIAL	DR	RELAY, SENSING (OVER-UNDER VOLTAGE)	
	CHK		
	APPD		
		SIZE	CODE IDENT NO.
		A	05869
		DRAWING NO.	719710
		REV	B
		SCALE	NONE
		WT:	NOTE 10
		SHEET	1 OF 12



CIRCUIT DIAGRAM
UN-ENERGIZED POSITION

FIGURE 2

SIZE	CODE IDENT. NO.	719710	REV
A	05869		B
SCALE	NONE	SHEET	2



SIZE A	CODE IDENT. NO. 05869	719710	REV P
SCALE NONE		SHEET 3	

NOTES:

1. PARTS SUPPLIED TO THIS DOCUMENT SHALL MEET THE GENERAL REQUIREMENTS OF SPECIFICATION MIL-R-28750 AND AS SPECIFIED HEREIN.
2. THE RELAY SHALL MEET THE ELECTRICAL REQUIREMENTS WHEN OPERATED UNDER THE FOLLOWING CONDITIONS:
 - (A) POWER/SIGNAL VOLTAGE:
 - (1) 120/208 VAC NOMINAL, 3 PHASE, WYE CONNECTED (4 WIRE INPUT), PHASE SEQUENCE ABC.
 - (2) RANGE OF OPERATION: 0 TO 175 VAC, PHASE TO NEUTRAL.
 - (B) POWER/SIGNAL FREQUENCY:
 - (1) 50, 60, 400 Hz NOMINAL (POWER SOURCE FREQUENCY).
 - (2) RANGE OF OPERATION: 47.5 TO 420 Hz.
 - (3) NO DAMAGE LIMIT: 45 TO 440 Hz.
 - (C) POWER/SIGNAL DISTORTION:
 - (1) TOTAL HARMONIC 5% MAXIMUM.
 - (2) INDIVIDUAL HARMONICS TO 7TH INCLUSIVE, EACH 3% MAXIMUM.
 - (D) POWER/SIGNAL MODULATION VOLTAGE INCLUDED IN NOMINAL OPERATION RANGE:

$$2\% \text{ MAXIMUM, } \%MOD = \frac{V_{MAX} - V_{MIN}}{V_{MAX} + V_{MIN}} \times 100$$

- (E) POWER/SIGNAL INPUT IMPEDANCE:
 - 1,000 OHMS MINIMUM EACH PHASE TO PHASE.
- (F) OVER/UNDER VOLTAGE FAULT OUTPUT (ABBREVIATED, FAULT OUTPUT):
 - T²L COMPATIBLE WITH A CAPABILITY OF SUPPLYING AT LEAST 1.0 MILLIAMPERE AT 3.5 ± 1 VOLT FROM AN INTERNAL SOURCE IMPEDANCE OF 1,000 OHMS MAXIMUM. AT +0.5, -0, IT SHALL BE CAPABLE OF SINKING 10 MILLIAMPERES MINIMUM. THE MINIMUM PULSE WIDTH SHALL BE 3 MS.

SIZE	CODE IDENT. NO.		REV
A	05869	719710	E
SCALE	NONE	SHEET	4

(G) POWER/SIGNAL AND FAULT OUTPUT ISOLATION:

THE IMPEDANCE BETWEEN TERMINAL 10 AND 1, 2, 3, 4 SHALL BE 50 K OHMS MINIMUM. THE RELAY CONTACTS SHALL BE ISOLATED FROM ALL VOLTAGE INPUT TERMINALS AND CASE. ALL TERMINALS SHALL ALSO BE ISOLATED FROM CASE BY 20 MEGOHMS MINIMUM, EXCEPT CASE GROUND.

(H) OPERATING POWER:

OPERATING POWER SHALL BE TAKEN FROM THE POWER/SIGNAL INPUT LINES.

(J) SIGNAL MONITORING:

ALL AC VOLTAGES ARE AVERAGE VALUES AS MEASURED BY AN RMS INDICATING, AVERAGE SENSING DIGITAL VOLTMETER OR EQUIVALENT.

3. VOLTAGE SENSING CHARACTERISTICS:

LIMIT 1: IF ANY PHASE OF THE NOMINAL INPUT VOLTAGE SHOULD INCREASE TO $129.5 + 3$, $-1V$, THE OTHER TWO PHASES HELD AT NOMINAL VOLTAGE OR IF ALL PHASES SIMULTANEOUSLY OF THE NOMINAL INPUT VOLTAGE SHOULD INCREASE TO $129.5 \pm 1V$, THE RELAY SHALL TRIP BETWEEN 1.8 AND 2.2 SECONDS; HOWEVER, IF THE VOLTAGE SHOULD DROP BELOW 128.5 VOLTS BEFORE 1.8 SECONDS, THE RELAY SHALL NOT TRIP. AFTER TRIP, IF THE VOLTAGE SHOULD DECREASE, THE RESET DIFFERENTIAL VOLTAGE SHALL NOT EXCEED 2.0 VOLTS. THE RESET TIME SHALL NOT EXCEED 0.2 SECOND.

LIMIT 2: IF ANY PHASE OF THE INPUT VOLTAGE SHOULD INCREASE ABOVE $161 \pm 2V$, THE RELAY SHALL TRIP WITHIN 150 MS. AFTER TRIP IF THE VOLTAGE SHOULD DECREASE BELOW LIMIT 1, THE RELAY SHALL PULL IN.

LIMIT 3: IF ANY PHASE OF THE NOMINAL INPUT VOLTAGE SHOULD DECREASE TO 104.5 ± 2 VOLTS, THE OTHER TWO PHASES HELD AT NOMINAL VOLTAGE OR IF ALL PHASES SIMULTANEOUSLY OF THE NOMINAL INPUT VOLTAGE SHOULD DECREASE TO 104.5 ± 2 VOLTS, THE RELAY SHALL TRIP BETWEEN 4.5 AND 5.5 SECONDS. HOWEVER, IF THE VOLTAGE SHOULD INCREASE ABOVE 102.5 VOLTS BEFORE 4.5 SECONDS,

SIZE A	CODE IDENT. NO. 05869	719710	REV E
SCALE NONE		SHEET	5

3. (CONTINUED)

LIMIT 3 (CONTINUED):

THE RELAY SHALL NOT TRIP. AFTER TRIP, IF THE VOLTAGE SHOULD INCREASE, THE RESET DIFFERENTIAL VOLTAGE SHALL NOT EXCEED 2.0 VOLTS. THE RESET TIME SHALL NOT EXCEED 0.2 SECONDS.

IF ALL PHASES SIMULTANEOUSLY SHOULD DECREASE TO $104.5 \pm 2V$, THE FAULT OUTPUT SHALL BE -0, +.5 VOLTS. IF THE VOLTAGE SHOULD INCREASE BACK TO 106.6 VOLTS OR HIGHER, THE FAULT OUTPUT SHALL BE 3.5 ± 1 VOLT. THE RESET DIFFERENTIAL VOLTAGE SHALL NOT EXCEED 2.0 VOLTS. THE RELAY IN EITHER CASE SHALL NOT TRIP IF THE EXCURSION TIME IS LESS THAN 4.5 SECONDS. THE RISE AND FALL TIME OF THE FAULT OUTPUT SHALL NOT EXCEED 0.1 MILLISECONDS, AND THE PULSE WIDTH SHALL NOT BE LESS THAN 3 MILLISECONDS.

IF ALL PHASES SIMULTANEOUSLY SHOULD DECREASE FROM NOMINAL TO 75 ± 5 VOLTS, THE DELAY TIME BETWEEN THE PASSING OF ANY ONE PHASE TO NEUTRAL INPUT THROUGH THE 104.5 ± 2 VOLTS REGION AND THE FAULT OUTPUT SHALL NOT BE GREATER THAN 6 MILLISECONDS AT 50 OR 60 Hz INPUT AND 1 MILLISECOND AT 400 Hz INPUT. IF ALL PHASES SIMULTANEOUSLY SHOULD INCREASE FROM 75 ± 5 VOLTS TO NOMINAL, THE DELAY TIME SHALL NOT BE GREATER THAN 2 MILLISECONDS.

LIMIT 4: THE SENSOR SHALL START TO OPERATE AND THE RELAY SHALL BECOME ENERGIZED WHEN THE THREE PHASE INPUT, FROM ZERO VOLTS, REACHES 90 VOLTS OR BEFORE. THE SENSOR SHALL CEASE TO OPERATE AT 45 VOLTS OR BELOW WHEN THE THREE PHASE NOMINAL INPUT IS REMOVED.

FAULT OUTPUT: IN ADDITION, A FAULT OUTPUT OF -0, +.5 VOLTS SHALL ALSO OCCUR WHENEVER THE LIMITS OF 1 AND 2 ARE EXCEEDED, TIMewise, TO OCCUR PRIOR TO THE OPENING OF THE CLOSED CONTACTS.

NO TRIP LIMIT: INPUT SIGNAL VARIATIONS OF A PULSE DURATION OF 100 μ SEC OR LESS, WHETHER IN OR OUT OF LIMITS 1, 2 OR 3, SHALL NOT CAUSE NUISANCE TRIP OR RESET OF RELAY, OR A FAULT OUTPUT.

SIZE A	CODE IDENT. NO. 05869	719710	REV E
SCALE NONE		SHEET 6	

3. (CONTINUED)

MISSING VOLTAGE: IF ANY ONE PHASE VOLTAGE IS NOT APPLIED OR REMOVED AFTER IT HAS BEEN APPLIED, THE OTHER TWO PHASES BEING CONTINUOUSLY APPLIED, CONTACTS 6 AND 13 SHALL REMAIN OR BECOME OPEN RESPECTIVELY. TRIP TIME SHALL BE NO GREATER THAN 0.2 SECONDS IF PHASE VOLTAGE IS APPLIED AND THEN REMOVED.

MONITORING TERMINALS: CONTACTS 5, 6 AND 13 SHALL BE MONITORED FOR THESE TESTS. CONTACTS 7, 8 AND 14 SHALL ONLY BE MONITORED WITH CONTACTS 5, 6 AND 13 DURING MISSING VOLTAGE TEST. TRIP TIME SHALL BE MONITORED AS THE OPENING OF CONTACTS 6 AND 13. SEE FIGURE 3.

NOMINAL OPERATION: CONTACTS 8 AND 14 AND 6 AND 13 SHALL BE CLOSED (HAVE CONTINUITY) WHEN 120 VOLTS $\pm 5\%$, -10% AND 50, 60 OR 400 Hz $\pm 5\%$ ARE APPLIED TO THEIR APPROPRIATE TERMINALS.

4. TEST CONDITIONS: WITH A 3 \emptyset POWER SOURCE THAT WILL PROVIDE A VARIABLE VOLTAGE ON EACH PHASE TO NEUTRAL, APPLY 120 VOLTS $\pm 1\%$, 60 ± 3 Hz BETWEEN TERMINALS 1, 2, 3 AND 4 WITH TERMINAL 11 CONNECTED TO POWER SOURCE GROUND, TEST AS FOLLOWS:

LIMIT 1: INCREASE PHASE A VOLTAGE FROM NOMINAL TO 129.5 ± 3 , -1 VOLTS AND RECORD THE TRIP TIME AND VOLTAGE. AFTER THE RELAY TRIPS, DECREASE PHASE A VOLTAGE TOWARD NOMINAL AND RECORD DIFFERENTIAL VOLTAGE AND RESET TIME. RECORD THE FAULT OUTPUT BEFORE AND AFTER THE RELAY TRIPS.

LIMIT 2: TRIP VOLTAGE - VARY PHASE A TO 161 ± 2 V AND RECORD TRIP VOLTAGE, REGARDLESS OF TRIP TIME. AFTER RELAY TRIPS, DECREASE PHASE A VOLTAGE TO NOMINAL. RECORD THE FAULT OUTPUT BEFORE AND AFTER THE RELAY TRIPS.

TRIP TIME - VARY PHASE A RAPIDLY THROUGH THE 161 ± 2 V REGION TO 170 ± 2 V AND RECORD TRIP TIME. AFTER RELAY TRIPS, DECREASE PHASE A VOLTAGE BELOW 128.5V.

SIZE A	CODE IDENT. NO. 05869	719710	REV E
SCALE NONE		SHEET 7	

4. (CONTINUED)

LIMIT 3: TRIP VOLTAGE - DECREASE ALL THREE PHASES SLOWLY FROM NOMINAL JUST PASS 104.5 ± 2 VOLTS AND RECORD THE TRIP VOLTAGE WHERE THE FAULT OUTPUT CHANGES FROM 3.5 ± 1 VOLT TO $-0, +0.5$ VOLTS. ALSO RECORD THE FAULT OUTPUT PULSE WIDTH AND FALL TIME. STARTING FROM 75 ± 5 VOLTS, INCREASE ALL THREE PHASES SLOWLY JUST PAST 104.5 ± 2 VOLTS AND RECORD THE TRIP VOLTAGE WHERE THE FAULT OUTPUT CHANGES FROM $-0, +0.5$ VOLTS TO 3.5 ± 1 VOLT. ALSO RECORD THE FAULT OUTPUT PULSE WIDTH AND RISE TIME.

TRIP TIME - DECREASE ALL PHASES SIMULTANEOUSLY FROM NOMINAL, VERY RAPIDLY THROUGH THE 104.5 ± 2 VOLT REGION TO 75 ± 5 VOLTS AND RECORD THE DELAY TIME BETWEEN THE PASSING OF ANY ONE PHASE TO NEUTRAL INPUT THROUGH THE 104.5 ± 2 VOLT REGION AND THE FAULT OUTPUT. INCREASE ALL PHASES SIMULTANEOUSLY FROM 75 ± 5 VOLTS VERY RAPIDLY THROUGH THE 104.5 ± 2 VOLT REGION TO NOMINAL AND RECORD THE DELAY TIME.

LIMIT 4: INCREASE THE THREE PHASE VOLTAGE FROM ZERO VOLTS TO NOMINAL AND RECORD THE TRIP VOLTAGE WHERE THE RELAY BECOMES ENERGIZED. DECREASE THE THREE PHASE VOLTAGE FROM NOMINAL TO ZERO VOLTS AND RECORD THE TRIP VOLTAGE WHERE THE RELAY DE-ENERGIZES.

REPEAT LIMIT 1 EXCEPT VARY PHASE B. REPEAT AGAIN EXCEPT VARY PHASE C. REPEAT LIMIT 1 FOR ALL THREE PHASES SIMULTANEOUSLY EXCEPT VARY TO 129.5 ± 1 VOLT.

REPEAT LIMIT 3 EXCEPT APPLY $400 \text{ Hz} \pm 20 \text{ Hz}$ TO INPUT.

5. DURING THE CHARACTERISTIC VOLTAGE SENSING TESTS, THE RELAY SHALL TRIP AND RESET IN THE SPECIFIED TIME AND AT THE SPECIFIED VOLTAGE. THE FAULT OUTPUT SHALL PERFORM AS SPECIFIED.

SIZE A	CODE IDENT. NO. 05869	719710	REV E
SCALE NONE		SHEET 8	

6. DIELECTRIC WITHSTANDING VOLTAGE: PER MIL-R-28750 EXCEPT THE VOLTAGE AMPLITUDE SHALL BE 1000 V RMS, 60 Hz BETWEEN PINS AND CASE.

7. INSULATION RESISTANCE: PER MIL-R-28750.

8. ENVIRONMENTAL REQUIREMENTS:

OPERATING TEMPERATURE: 0°C TO +71°C

STORAGE TEMPERATURE: -20°C TO +85°C

VIBRATION: PER MIL-R-28750 EXCEPT THE AMPLITUDE AND FREQUENCY SHALL BE 10 G'S, 10 TO 500 Hz.

SHOCK: PER MIL-R-28750, 100 G'S, 6 MS DURATION.

THERMAL SHOCK: PER MIL-R-28750.

MOISTURE RESISTANCE: PER MIL-R-28750.

SALT SPRAY: PER MIL-R-28750.

ENDURANCE PER MIL-R-28750 EXCEPT THAT ONLY 50,000 OPERATIONS SHALL BE PERFORMED. A CYCLE IN THIS LIFE TEST IS DEFINED AS FOLLOWS:

APPLY $120 \pm 1\%$, 60 ± 3 Hz BETWEEN TERMINALS 1, 2, 3 AND 4
INCREASE THE VOLTAGE TO 135 VOLTS FOR 10 SECONDS. DECREASE TO 120 VOLTS FOR 20 SECONDS THEN DECREASE THE VOLTAGE TO 100 VOLTS FOR 10 SECONDS, INCREASE THE VOLTAGE TO 120 VOLTS FOR 20 SECONDS. THE CONTACT LOAD SHALL BE 5 AMPERES RESISTIVE AT 28 VDC AND THE TEMPERATURE SHALL BE +71°C. AFTER LIFE, PERFORM INSULATION RESISTANCE, DIELECTRIC WITHSTANDING VOLTAGE, CONTACT RESISTANCE AND THE OPERATING CHARACTERISTIC TESTS. AFTER LIFE THE CONTACT VOLTAGE DROP SHALL NOT EXCEED 200 mV.

9. RELAY USED INTERNALLY SHALL MEET ALL REQUIREMENTS OF THIS SPECIFICATION.

10. MECHANICAL REQUIREMENTS:

(B)

WEIGHT _____ 34 OUNCES MAXIMUM

TERMINALS _____ SOLDER HOOK, SUITABLY THREADED TO FACILITATE SOLDERING

MOUNTING ATTITUDE _____ THE RELAY SHALL MEET ALL REQUIREMENTS WHEN MOUNTED IN ANY POSITION.

SIZE A	CODE IDENT. NO. 05869	719710	REV E
SCALE NONE		SHEET 9	

11. MARKING. EACH RELAY SHALL BE PERMANENTLY AND LEGIBLY MARKED WITH THE FOLLOWING INFORMATION IN ACCORDANCE WITH MIL-STD-130:

- (A) THE HUGHES-FULLERTON PART IDENT NUMBER
- (B) MANUFACTURER'S NAME OR SYMBOL AND PART NUMBER
- (C) EIA DATE CODE
- (D) TERMINAL IDENTIFICATION
- (E) CIRCUIT DIAGRAM

TABLE I - RELAY REQUIREMENTS

HUGHES PART IDENT NUMBER	CONTACT ARRANGEMENT	CONTACT RATING AT 28 VDC OR 115 VAC		CONTACT BOUNCE MAXIMUM
		RESISTIVE	INDUCTIVE	
719710-1	DPDT	5 AMPS	2 AMPS	2 MILLISECONDS

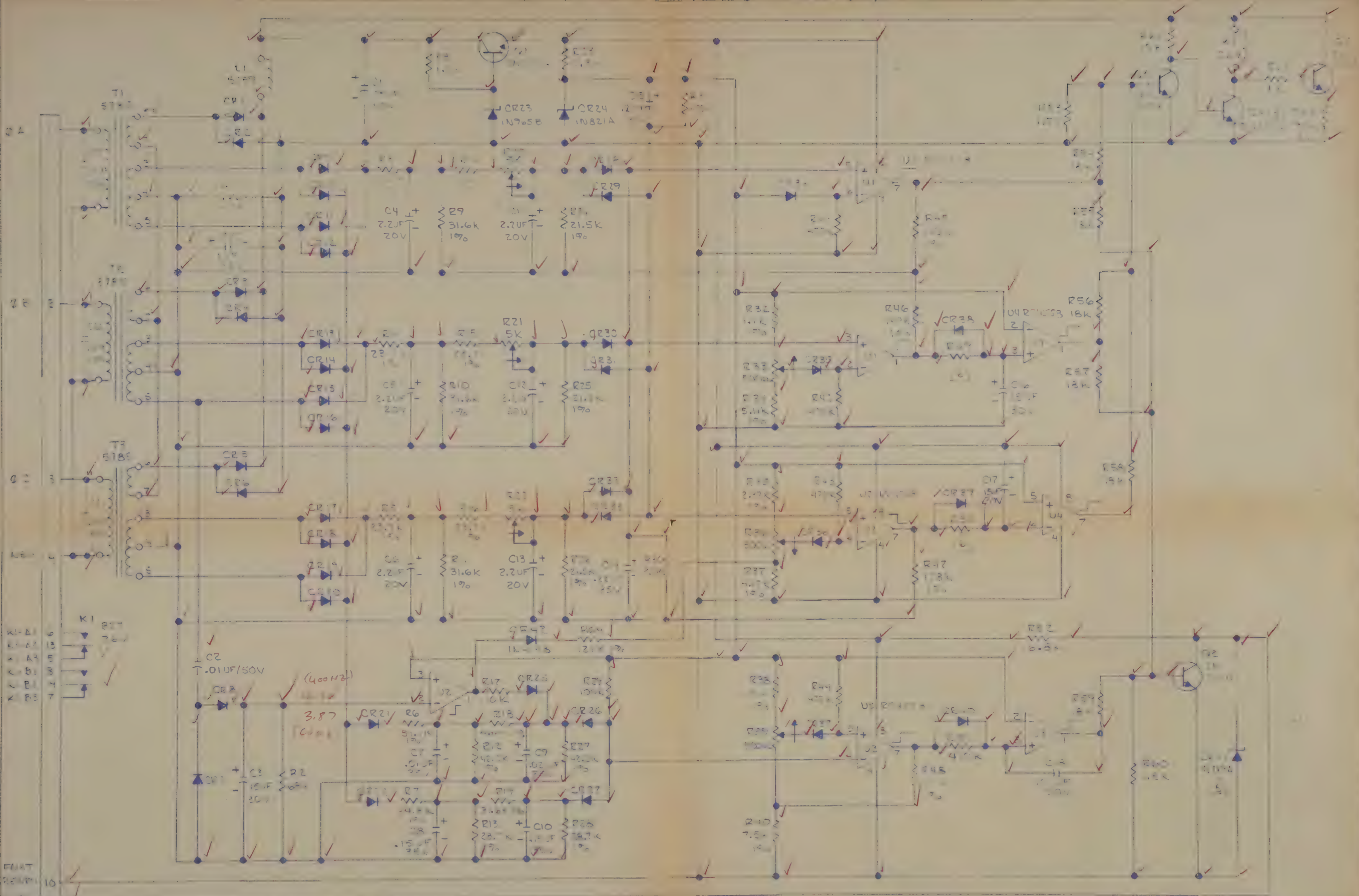
SIZE A	CODE IDENT. NO. 05869	719710	REV 1
SCALE	NONE	SHEET	10

HUGHES IDENT NUMBER	SUPPLIER PART NUMBERS		
	PARKO ELECTRONICS		
719710-1	101280		

SUGGESTED SOURCE(S) OF SUPPLY:

PARKO ELECTRONICS INC., SANTA ANA, CALIF. FSCM 13979

SIZE A	CODE IDENT. NO. 05869	719710	REV B
SCALE NONE		SHEET 12	



KI-A1 6
 KI-A2 13
 KI-A3 5
 KI-B1 8
 KI-B2 4
 KI-B3 7
 KI-B4 7
 KI-B5 7
 KI-B6 7
 KI-B7 7
 KI-B8 7
 KI-B9 7
 KI-B10 7
 KI-B11 7
 KI-B12 7
 KI-B13 7
 KI-B14 7
 KI-B15 7
 KI-B16 7
 KI-B17 7
 KI-B18 7
 KI-B19 7
 KI-B20 7
 KI-B21 7
 KI-B22 7
 KI-B23 7
 KI-B24 7
 KI-B25 7
 KI-B26 7
 KI-B27 7
 KI-B28 7
 KI-B29 7
 KI-B30 7
 KI-B31 7
 KI-B32 7
 KI-B33 7
 KI-B34 7
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 KI-B93 7
 KI-B94 7
 KI-B95 7
 KI-B96 7
 KI-B97 7
 KI-B98 7
 KI-B99 7
 KI-B100 7

- 1 SELECTED AFTER ASSY PER ES 979
- 2 SELECTED BEFORE ASSY PER ES 978
- 3 CR1 THRU CR 22, 1N645: CR23 THRU CR40 & CR42, 1N4148
- 4 ASSEMBLY: 101222
- 5 PARTS LIST: PL10122
- 6 TOP DRAWING: 101220

DIMENSIONS ARE IN INCHES AND AFTER PLATING		CIR 11-23-74		CHK 11-23-74	
TOLERANCES (unless otherwise specified)		DSGN 11-23-74		PROJ 11-23-74	
X .1		APPROVED		REL 11-23-74	
XX .03		APPROVED		DO NOT SCALE DRAWING	
XXX .010		CODE IDENT NO		SIZE	
ANGLES .05		13979		2-101220	
MACH		SCALE		REV	
SURF					

Parko
 ELECTRONICS COMPANY INC. SANTA ANA, CALIF.

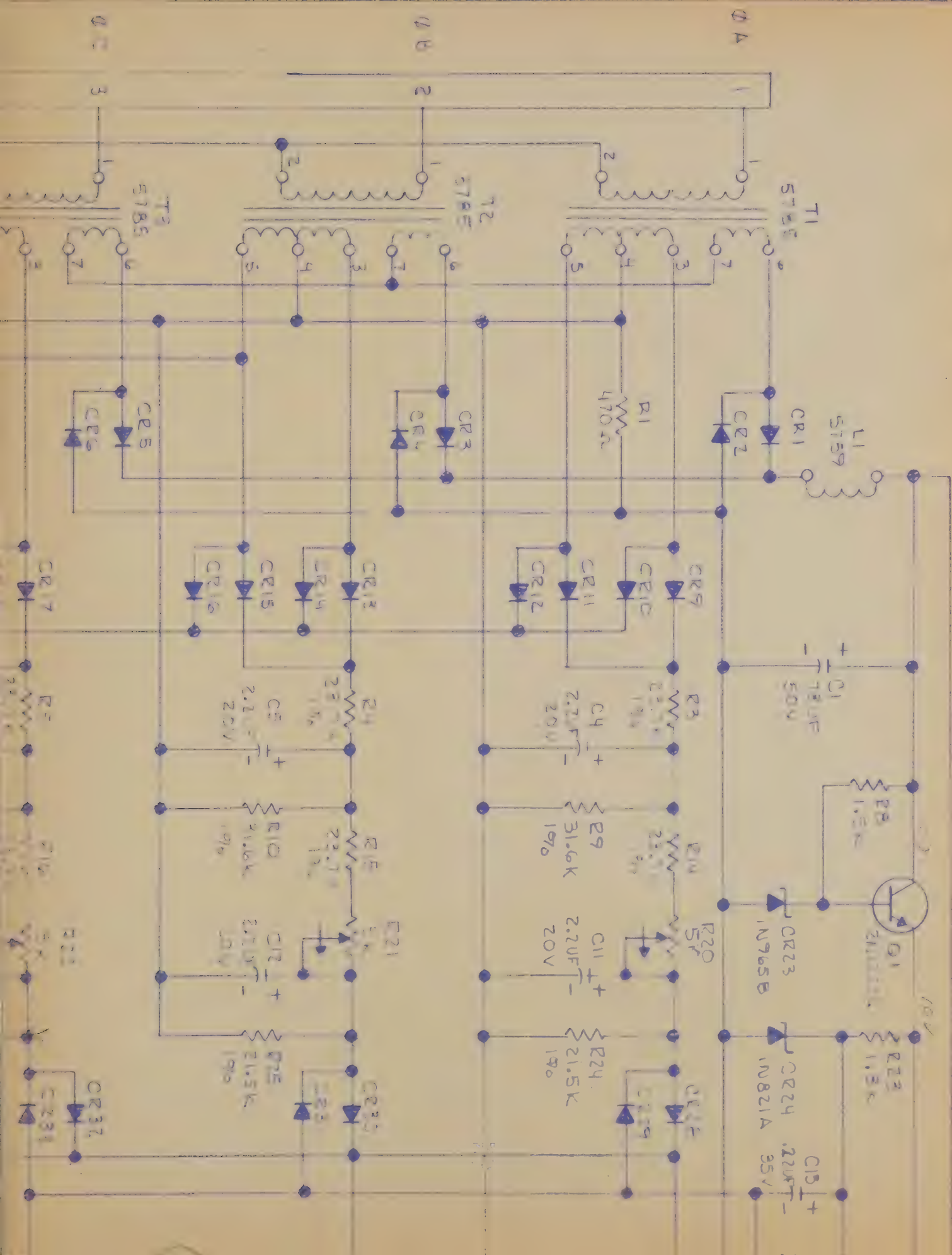
SCHEMATIC -
 SEL-311 RELAY - OVER CURRENT PROTECT

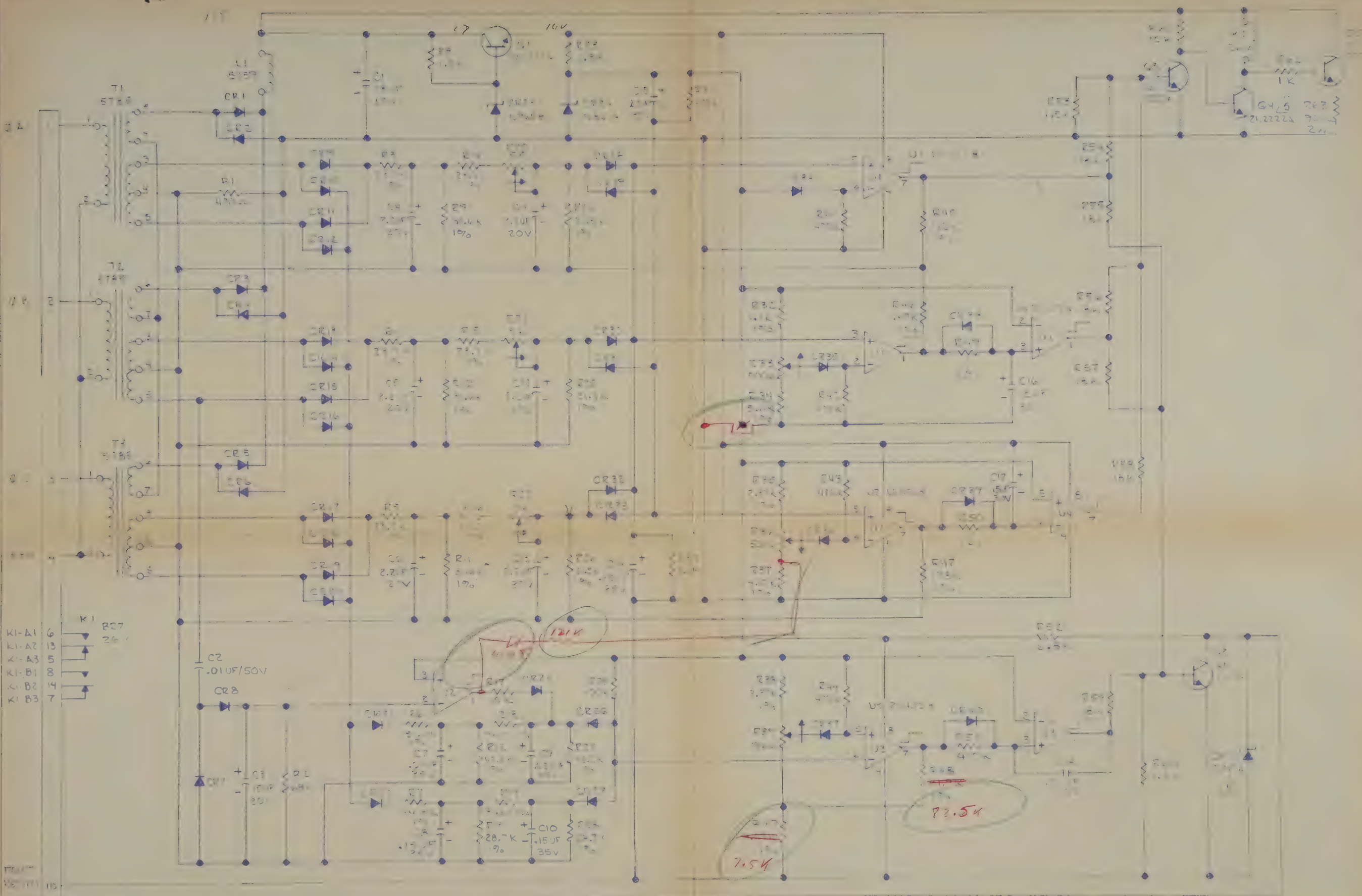
✓
CORRO - 5/11/75

5/11/75

PLEASE MAKE THESE COMMENTS
TO THE SCHEMATIC AND
BILL OF MATERIALS.

205





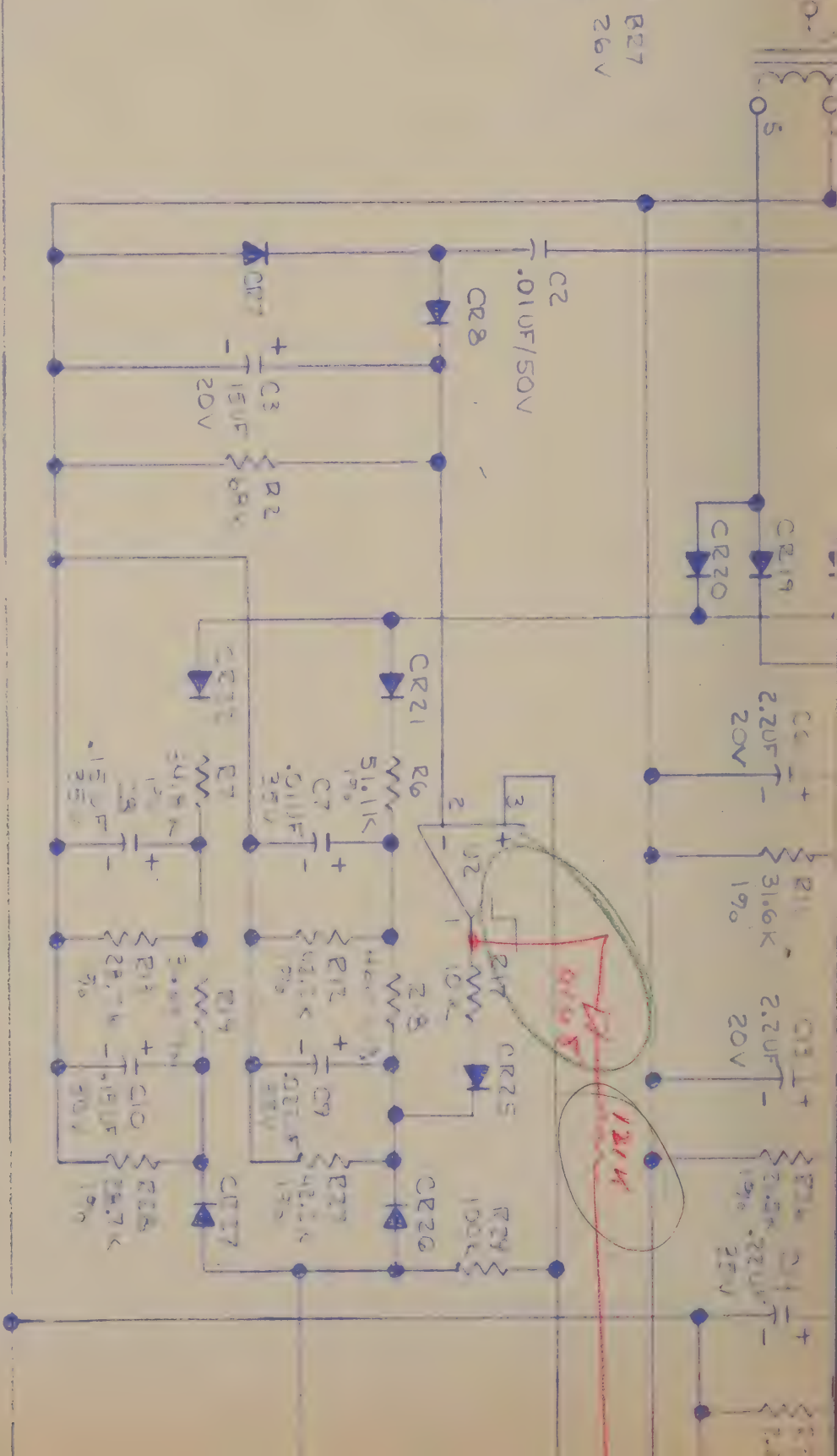
KI-A1 6
KI-A2 13
KI-A3 5
KI-B1 8
KI-B2 14
KI-B3 7

1. SELECTED BEFORE ASSY PER ES 977
2. SELECTED BEFORE ASSY PER ES 978
3. CR1 THRU CR 22, 1N645; CR 23 THRU CR 40, 1N4148
4. C1, C2, C3, C4, C5, C6, C7, C8, C9, C10
5. R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11, R12, R13, R14, R15, R16, R17, R18, R19, R20, R21, R22, R23, R24, R25, R26, R27, R28, R29, R30, R31, R32, R33, R34, R35, R36, R37, R38, R39, R40

DIMENSIONS ARE IN INCHES AND AFTER PLATING TOLERANCES (unless otherwise specified) X .01 XX .03 XXX .010 ANGLES .05 MACH SURF ✓	DR	11-20-74	Parko ELECTRONIC COMPANY INC., SANTA ANA, CALIF		
	CHK	11-20-74			
	DSGN		SCHEMATIC - SENSING RELAY-OVER/UNDER VOLTAGE		
	PROJ				
	REL	11-20-74	CODE IDENT NO. 13979 SIZE C 101281 REV		
	APPROVED		SCALE — SHEET 1 OF 1		
	APPROVED				
	DO NOT SCALE DRAWING				

K1-A1 6
 K1-A2 13
 K1-A3 5
 K1-B1 8
 K1-B2 4
 K1-B3 7

FAULT
 RETURN 10
 0V/0V 9
 FAULT 11



SELECTED AFTER ASSY PER ES 979
 SELECTED BEFORE ASSY PER ES 978

CR THRU CR22, IN645; CR23 THRU CR40, INH148

ASSEMBLY: 101282

PARTS LIST: 101280

TOP DRAWING: 101280

Parko

ELECTRONICS CO., INC.
SANTA ANA, CALIFORNIA

PARTS LIST & TRACEABILITY RECORD

DATE 08-17-76 PARKO P/N 601780 CUSTOMER P/N 714710-1 SHOP ORDER NO. 0

CUSTOMER & P.O. NO. QTY S/N THRU

REF. DES.	P/N	DESCRIPTION	QTY PER UNIT	TOTAL QTY	INSP	MANUFACTURER	PARKO P.O. NO.	LOT
0001	KC4558DN	POAC OP-AMP	1					
0002	11	11 11	1					
01-113	11	11 11	1					
004	11	11 11	1					
Q1	242222A	WPN-242222	1					
Q2	11	11 11	1					
Q3	11	11 11	1					
Q4	11	11 11	1					
Q5	11	11 11	1					
CR1	11	11 11	1					
CR2	11	11 11	1					
CR3	11	11 11	1					
CR4	11	11 11	1					
CR5	11	11 11	1					
CR6	11	11 11	1					
CR7	11	11 11	1					
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CR94	11	11 11	1					
CR95	11	11 11	1					
CR96	11	11 11	1					
CR97	11	11 11	1					
CR98	11	11 11	1					
CR99	11	11 11	1					
CR100	11	11 11	1					

Pariko

ELECTRONICS CO., INC.
SANTA ANA, CALIFORNIA

PARTS LIST & TRACEABILITY RECORD

DATE

PARKO P/N 101180

CUSTOMER P/N

SHOP ORDER NO.

CUSTOMER & P.O. NO.

QTY

S/N

THRU

REF. DES.	P/N	DESCRIPTION	QTY PER UNIT	TOTAL QTY	INSP	MANUFACTURER	PARKO P.O. NO.	LOT
C3	CS13	15/20V CAP	1					
C4	CS13	2.2/20V CAP	1					
C5	CS13	2.2/20V CAP	1					
C6	CS13	2.2/20V CAP	1					
C7	CS13(150D)	.01/35 CAP	1					
C8 (CS13)(150D)		.15/35 CAP	1					
C9	CS13(150D)	.022/35 CAP	1					
C10	CS13(150D)	.15/35 CAP	1					
C11	CS13	2.20/20 CAP	1					
C12	CS13	2.20/20 CAP	1					
C13	CS13	2.20/20 CAP	1					
C14	CS13(150D)	.022/35 CAP	1					
C15	CS13(150D)	.22/35 CAP	1					
C16	CS12	.01/50 CAP	1					
C17	69F	15/30V CAP	1					
C18	69F	15/30V CAP	1					
B1	RC07	1.5M RES	1					
R2	RC07	1.5M RES	1					

Partko

ELECTRONICS CO., INC.

SANTA ANA, CALIFORNIA

PARTS LIST & TRACEABILITY RECORD

DATE

PARKO P/N

CUSTOMER P/N

SHOP ORDER NO.

CUSTOMER & P.O. NO.

QTY

S/N

THRU

REF. DES.	P/N	DESCRIPTION	QTY PER UNIT	TOTAL QTY	INSP	MANUFACTURER	PARKO P.O. NO.	LOT
R3 R3 ✓	RC07	1.8M RES.	1					
R4 R4 ✓	RM60	23.2 M "	1					
R5 R5 ✓	RM60	23.2 M "	1					
R6 R6 ✓	RM60	23.2 M "	1					
R7 R7 ✓	RM60	51.1 M "	1					
R8 R8 ✓	RM60	34.8 M "	1					
R9 R9 ✓	RM60	31.6 M "	1					
R10 R10 ✓	RM60	31.6 M "	1					
R11 R11 ✓	RM60	31.6 M "	1					
R12 R12 ✓	RM60	42.2 M "	1					
R13 R13 ✓	RM60	28.7 M "	1					
R14 R14 ✓	RM60	23.2 M "	1					
R15 R15 ✓	RM60	23.2 M "	1					
R16 R16 ✓	RM60	23.2 M "	1					
R17 R17 ✓	RM60	40.4 M "	1					
R18 R18 ✓	RM60	31.6 M "	1					
R19 R19 ✓	3329H	5M POT	1					
R20 R20 ✓	3329H	5M POT	1					
R21 R21 ✓	3329H	5M POT	1					

DATE

PARTNO P/N

CUSTOMER P/N

SHOP ORDER NO.

CUSTOMER & P.O. NO.

QTY

S/N

THRU

REF. DES.	P/N	DESCRIPTION	QTY PER UNIT	TOTAL QTY	INSP	MANUFACTURER	PARTO P.O. NO.	LOT
R22017	R2007	10A RES.	1					
R23022	R2060	42.2M	1					
R24015	R2060	28.7M	1					
R25014	R2060	21.5M	1					
R26015	R2060	21.5M	1					
R27014	R2060	21.5M	1					
R28014	R2007	100M	1					
R29021	R2007	470M	1					
R30014	R2007	2.2M	1					
R31021	R2060	2.37M	1					
R32021	3329M	500M POT	1					
R33014	R2060	1.09M RES.	1					
R34014	R2007	470M	1					
R35014	R2007	470M	1					
R36014	R2060	61.9M	1					
R37014	R2060	1.1M	1					
R38014	3329M	500M POT	1					
R39014	R2060	5.11M RES.	1					
R40014	R2060	2.37M	1					

DATE

PARKO P/N

101280

CUSTOMER P/N

SHOP ORDER NO.

CUSTOMER & P.O. NO.

QTY

S/N

THRU

REF. DES.	P/N	DESCRIPTION	QTY PER UNIT	TOTAL QTY	INSP	MANUFACTURER	PARKO P.O. NO.	LOT
R41 134 ✓	3329H	500n POT	1					
R42 137 ✓	R-160	4.22M RES	1					
R43 151 ✓	RC007	420M "	1					
R44 141 ✓	RC007	420M "	1					
R45 143 ✓	RC007	420M "	1					
R46 142 ✓	RC007	420M "	1					
R47 145 ✓	R-160	110M "	1					
R48 146 ✓	R-160	147M "	1					
R49 147 ✓	R-160	173M "	1					
R50 152 ✓	RC007	6.2M "	1					
R51 154 ✓	RC007	18M "	1					
R52 154 ✓	RC007	12M "	1					
R53 153 ✓	RC007	12M "	1					
R54 144 ✓	R-160	2 ADJUSTABLE	APPROX =	28M FOR 27.5 SDC.				
R55 150 ✓	R-160	2 ADJUSTABLE	APPROX =	35M FOR 51.5 SDC.				
R56 160 ✓	RC007	115M RES.	1					
R57 153 ✓	RC007	115M "	1					
R58 141 ✓	RC007	11M "	1					
R59 162 ✓	RC007	1M "	1					

ELECTRONICS CO., INC.
SANTA ANA, CALIFORNIA

DATE _____

PARKO P/N

CUSTOMER P/N

SHOP ORDER NO.

CUSTOMER & P.O. NO.

QTY

S/N.

THRU

[illegible]

Parko

ELECTRONICS CO., INC.
SANTA ANA, CALIFORNIA

PARTS LIST & TRACEABILITY RECORD

DATE

PARKO P/N

CUSTOMER P/N

SHOP ORDER NO.

CUSTOMER & P.O. NO.

QTY

S/N

THRU

REF. DES.	P/N	DESCRIPTION	QTY PER UNIT	TOTAL QTY	INSP	MANUFACTURER	PARKO P.O. NO.	LOT
CR1 ✓	1N645							
CR2 ✓	↑							
CR3 CR4								
CR4 CR3								
CR5 CR6								
CR6 CR5								
CR7 ✓								
CR8 CR9								
CR9 CR10								
CR10 CR11								
CR11 CR12								
CR12 CR13								
CR13 CR14								
CR14 CR15								
CR15 CR16								
CR16 CR17								
CR17 CR18								
CR18 CR19	↓							
CR19 CR20	1N645							

DATE

PARKO P/N

CUSTOMER P/N

SHOP ORDER NO.

CUSTOMER & P.O. NO.

QTY

S/N

THRU

REF. DES.	P/N	DESCRIPTION	QTY PER UNIT	TOTAL QTY	INSP	MANUFACTURER	PARKO P.O. NO.	LOT
CR20 CR8	1N645							
CR21 ✓	1N645							
CR22 ✓	1N645							
CR23 ✓	1N965B							
CR24 ✓	1N821A							
CR25 ✓	1N4148							
CR26 ✓								
CR27 ✓								
CR28 ✓								
CR29 ✓								
CR30 ✓								
CR31 ✓								
CR32 ✓								
CR33 ✓								
CR34 CR17								
CR35 CR37								
CR36 CR35								
CR37 CR36								
CR38 CR49								
CR39 CR58								
CR40 CR39								
CR41 ✓								

1N4148
1N749A

101280

old wiring
(Before mod)

C1 FT

C11 R24 FT

C12 R25 FT

C13 R26 FT

FT CR7

FT

CT

R12

R13

R1

add

ZA2E103

.01/400V cap 3 place

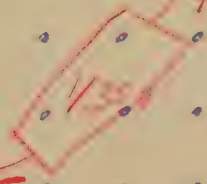
CS13, 1/35V cap 1 place

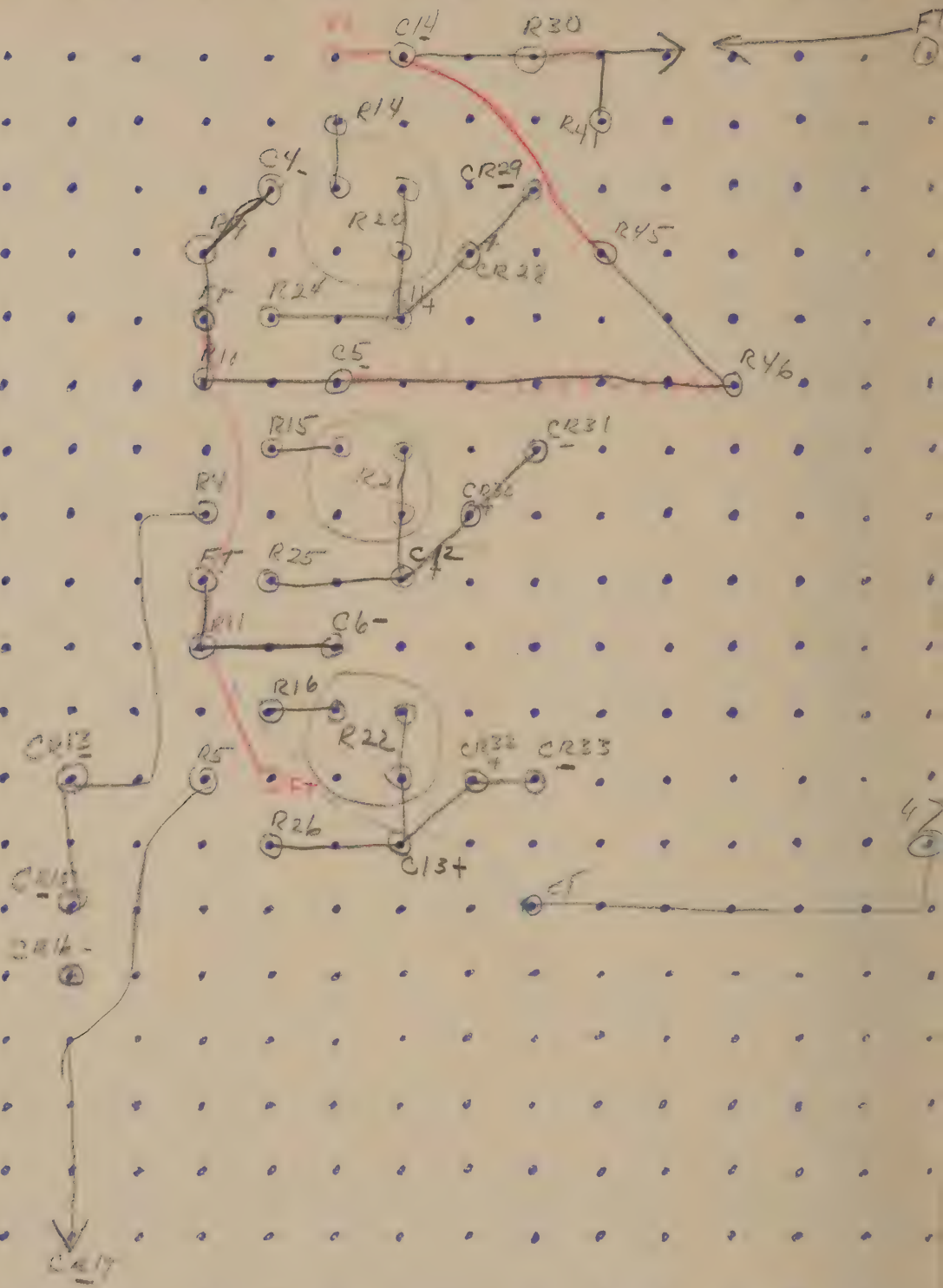
Change

FT

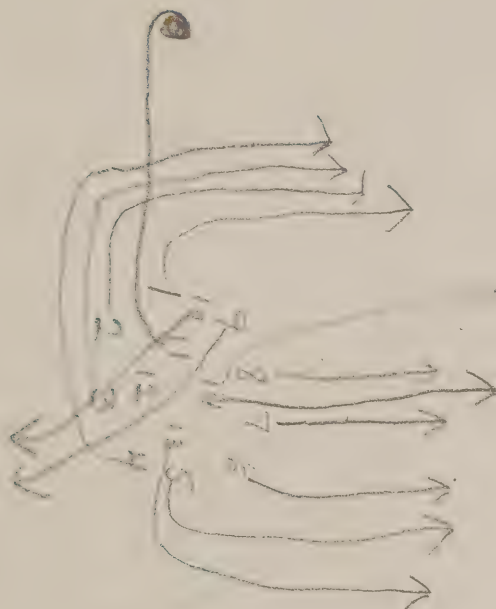
R38 S/B 1.96K

R48 S/B 287K





cramer FOR BOURNS®



cramer

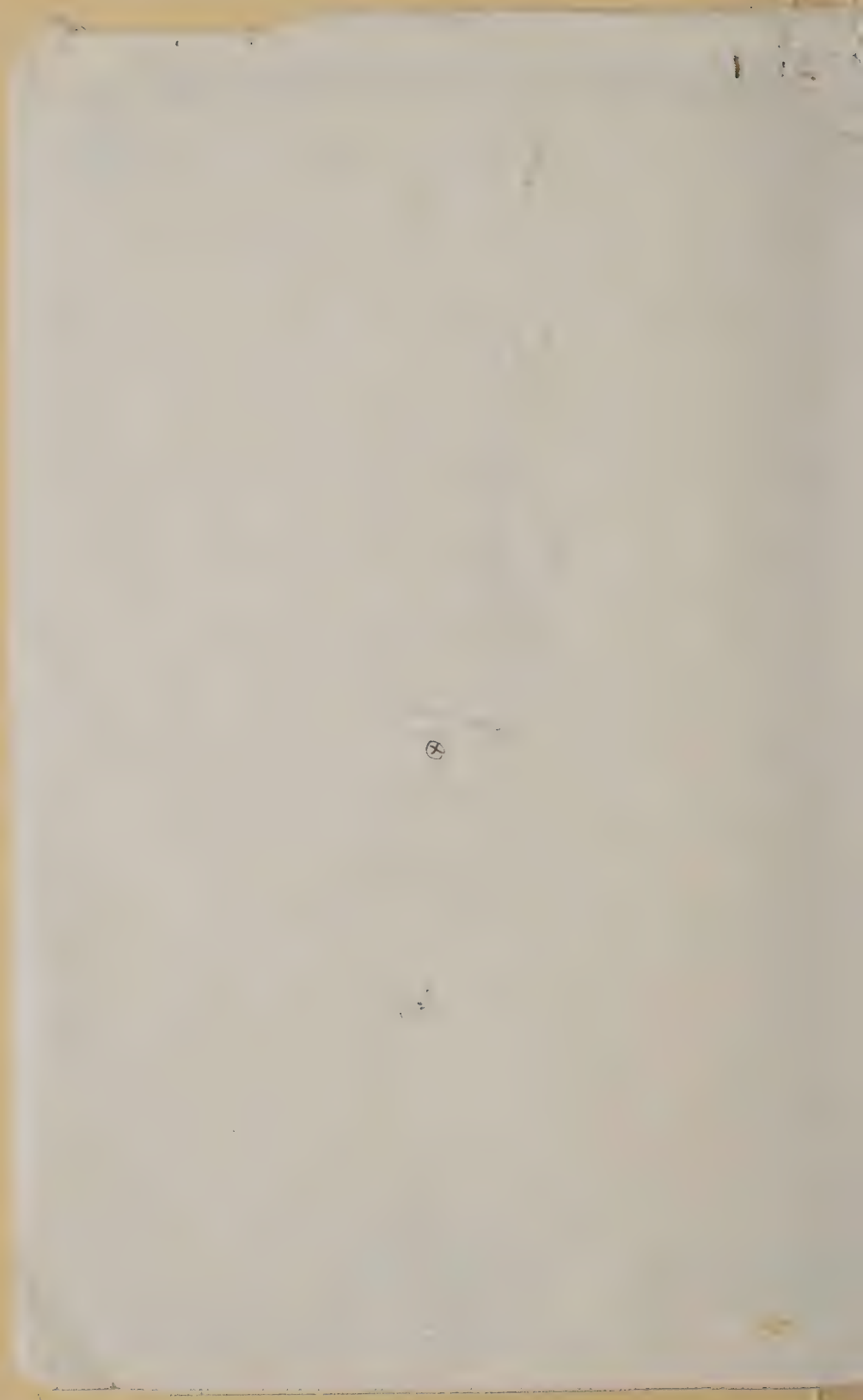


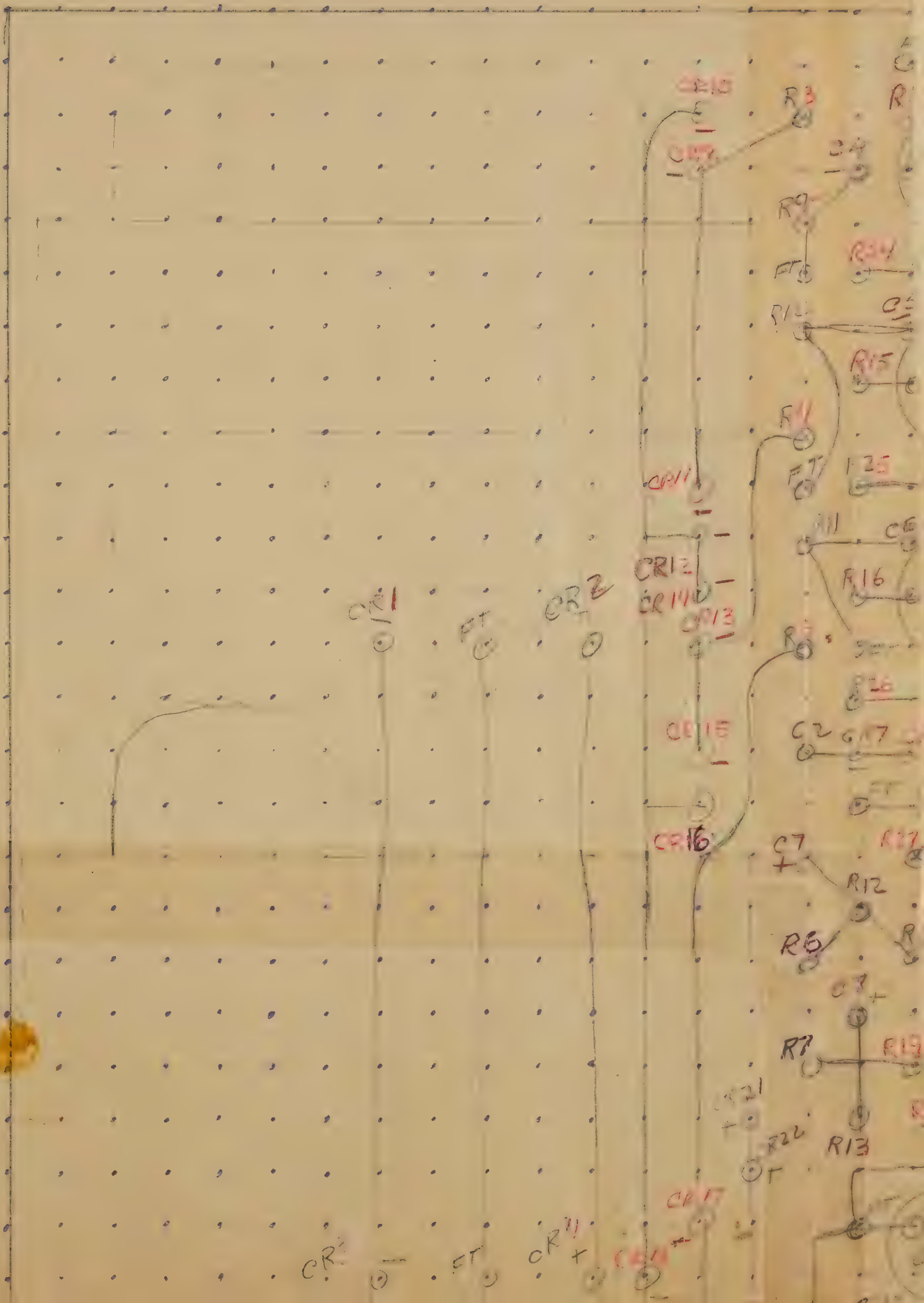
cramer

CRAMER/LOS ANGELES

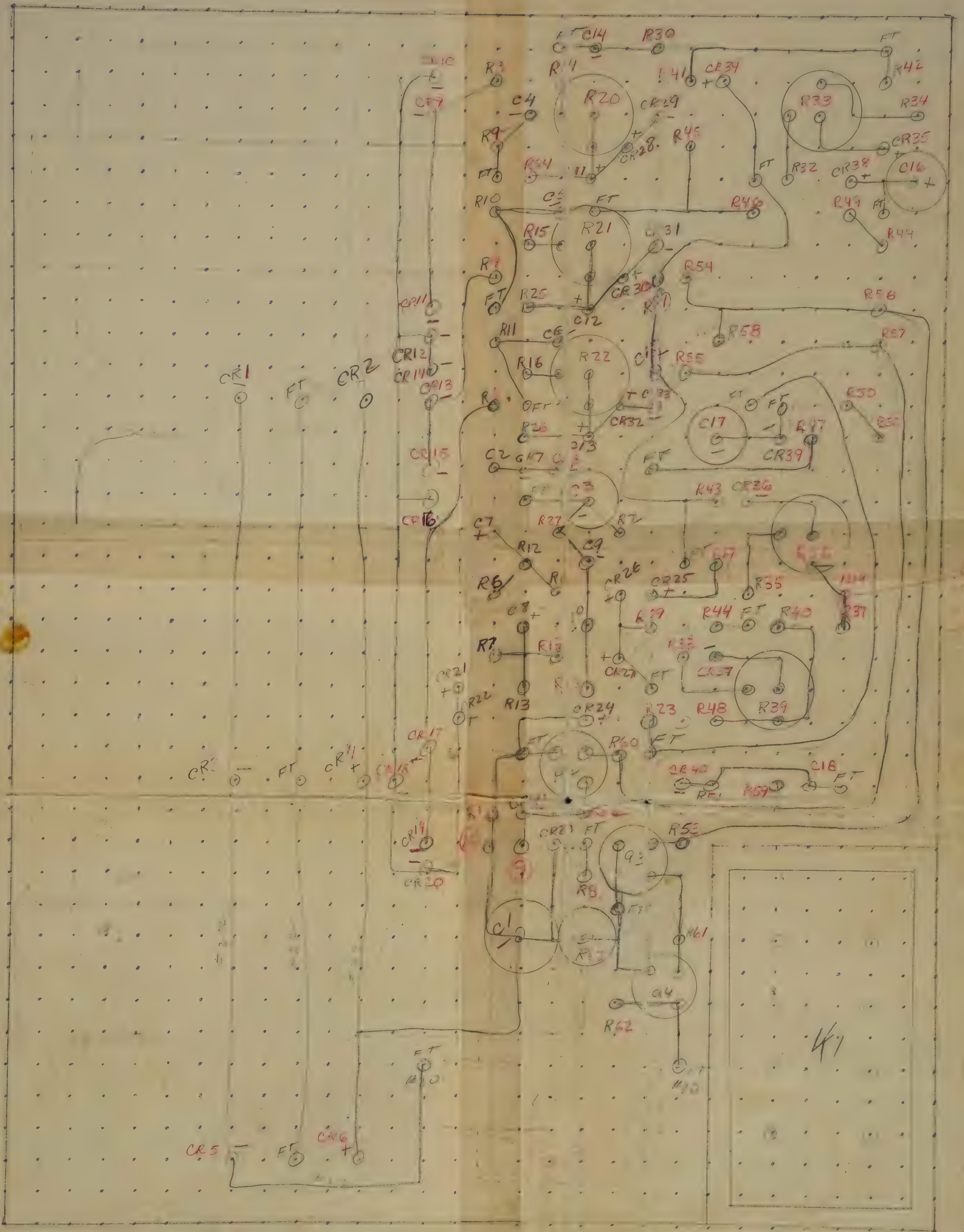
17201 Daimler Street Irvine, California 92705

Telephone: (714) 979-3000; (213) 771-8300



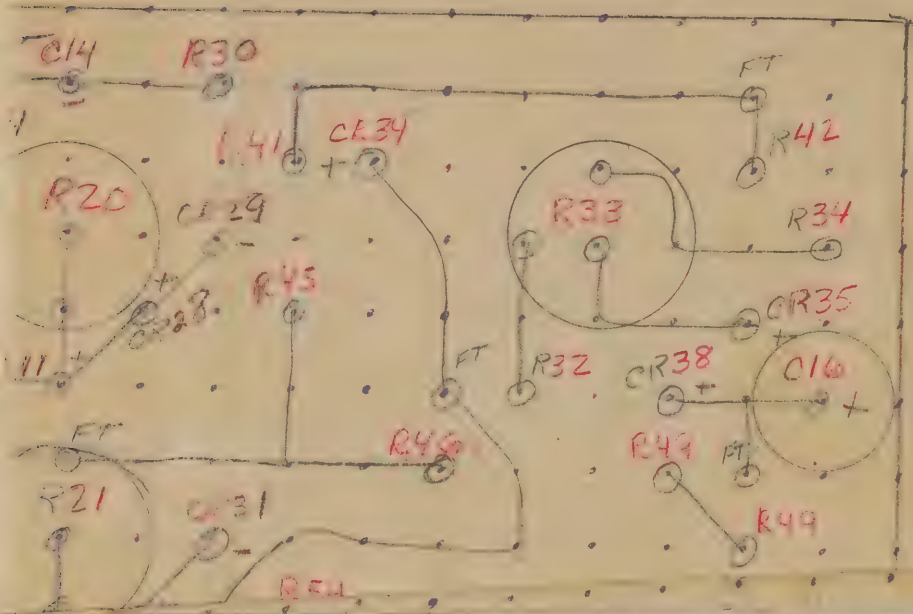




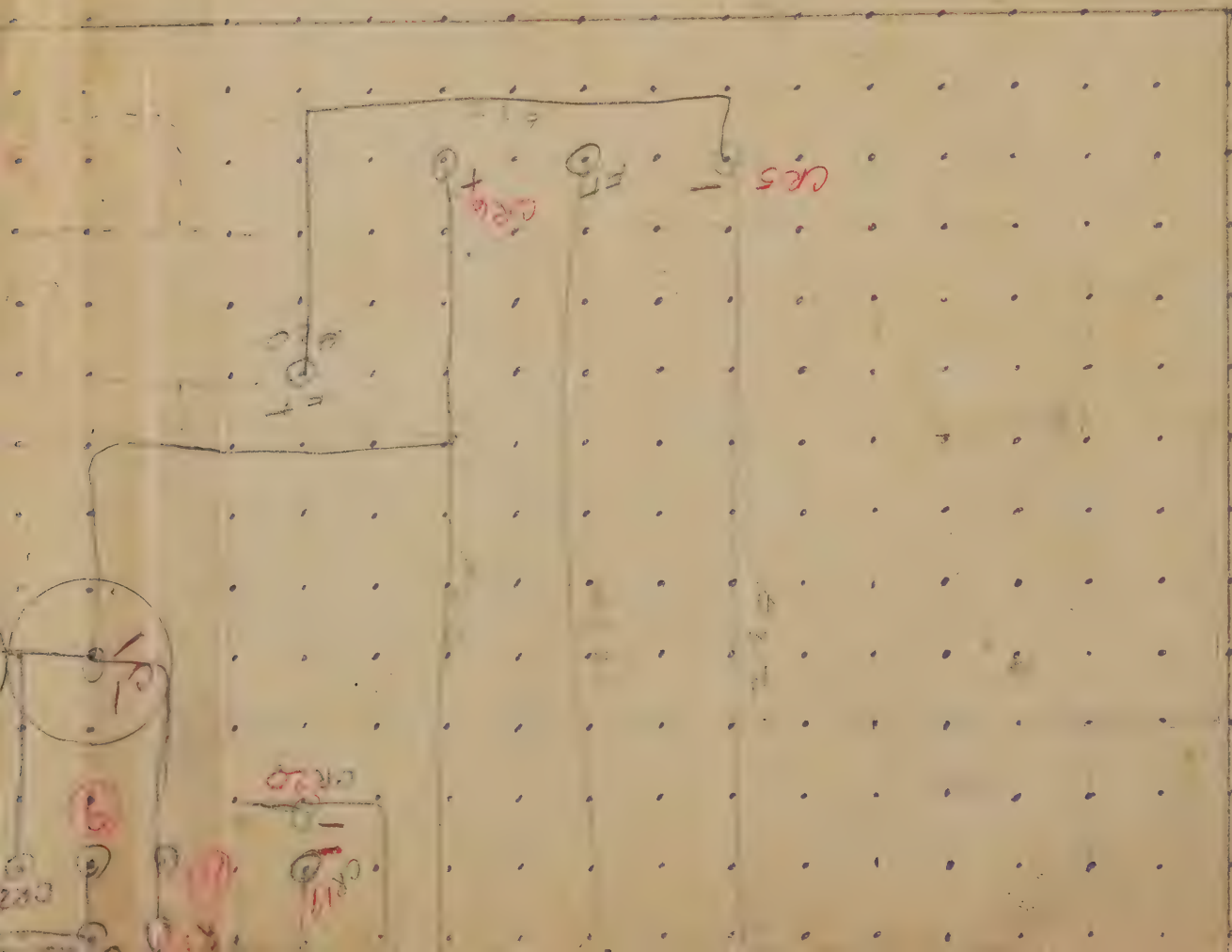


Current Reg. Design 11-15-74

See Notes in Design 1.15 for details #22



Current Ray Diagram 11-18-74
 Spec. Return. 1.15A
 #22



10/22/00

TL 1



TL 2

1. 10/22/00
2. 10/22/00
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100. 10/22/00

12 - 10/22/00

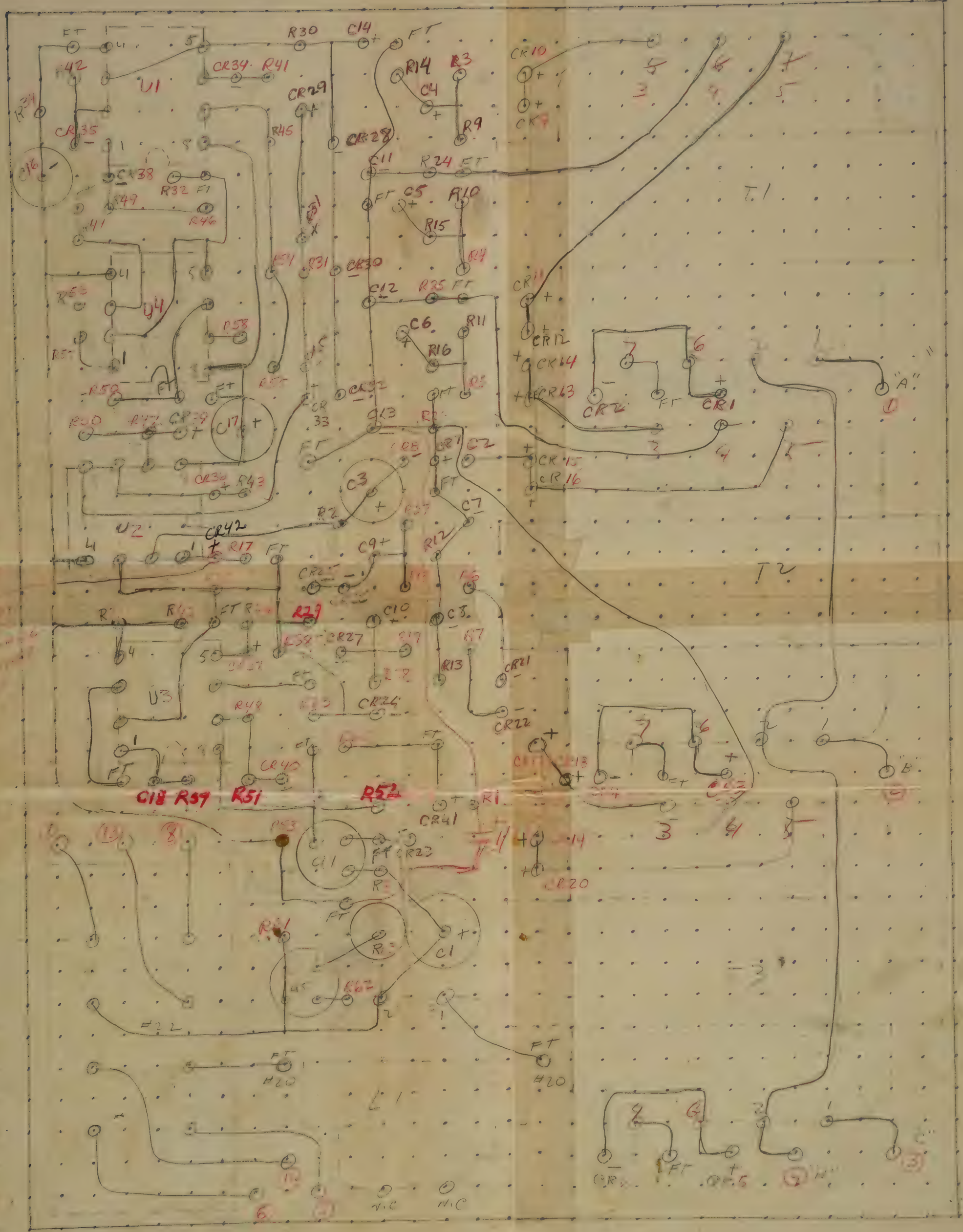
13 - 10/22/00
14 - 10/22/00
15 - 10/22/00

16 - 10/22/00
17 - 10/22/00
18 - 10/22/00

19 - 10/22/00

CR42

CR41



10/22/20

TR 1



TR 2

- 1 - brown
- 2 - light
- 3 - dark
- 4 - yellow

12 - red

13 - green

14 - yellow

5 - green

6 - blue

7 - vio

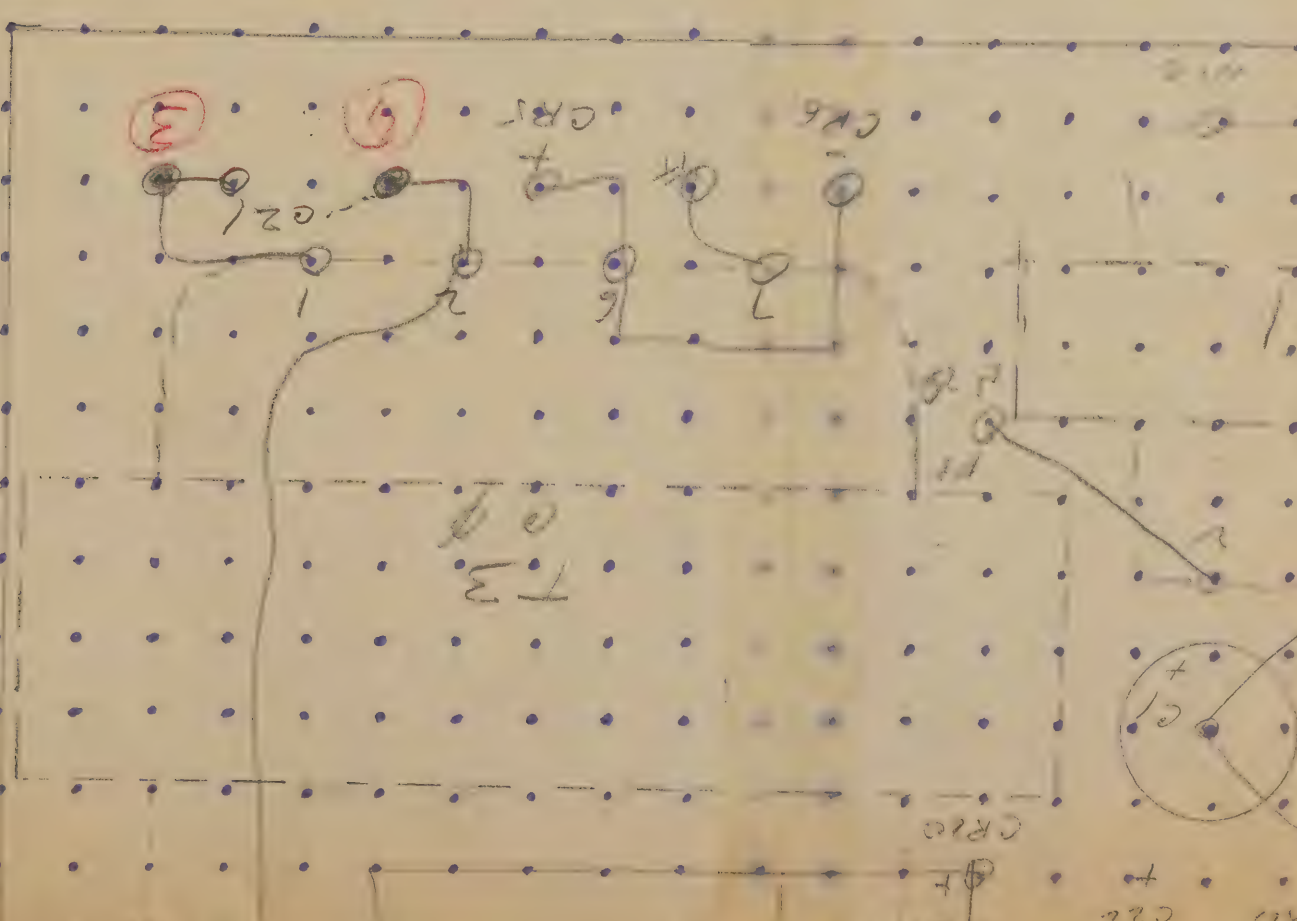
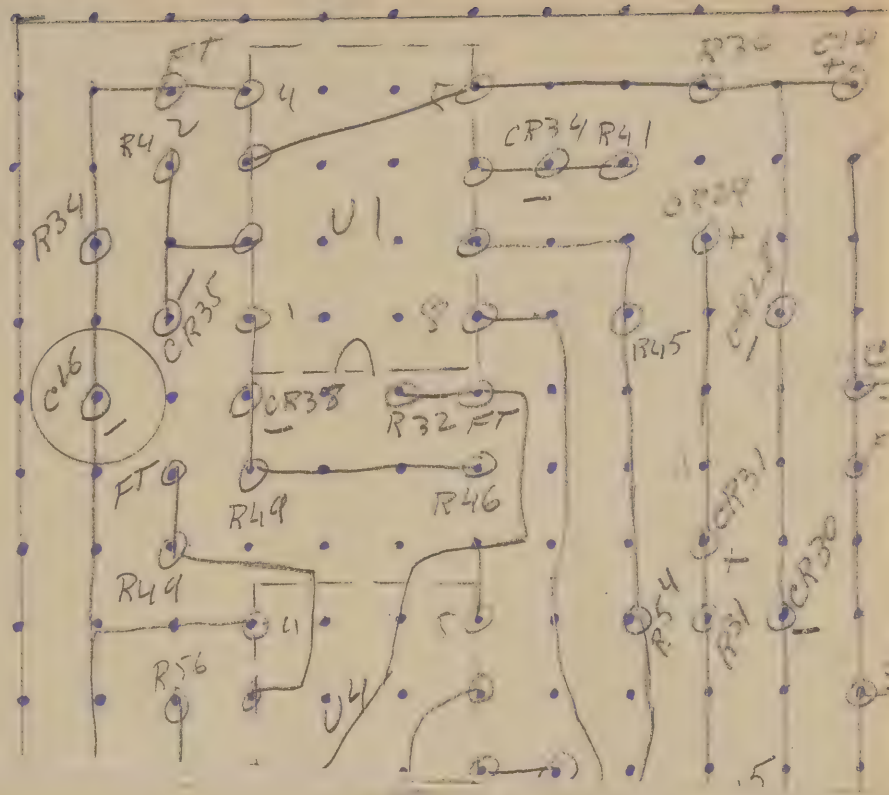
8 - yellow

9 - green

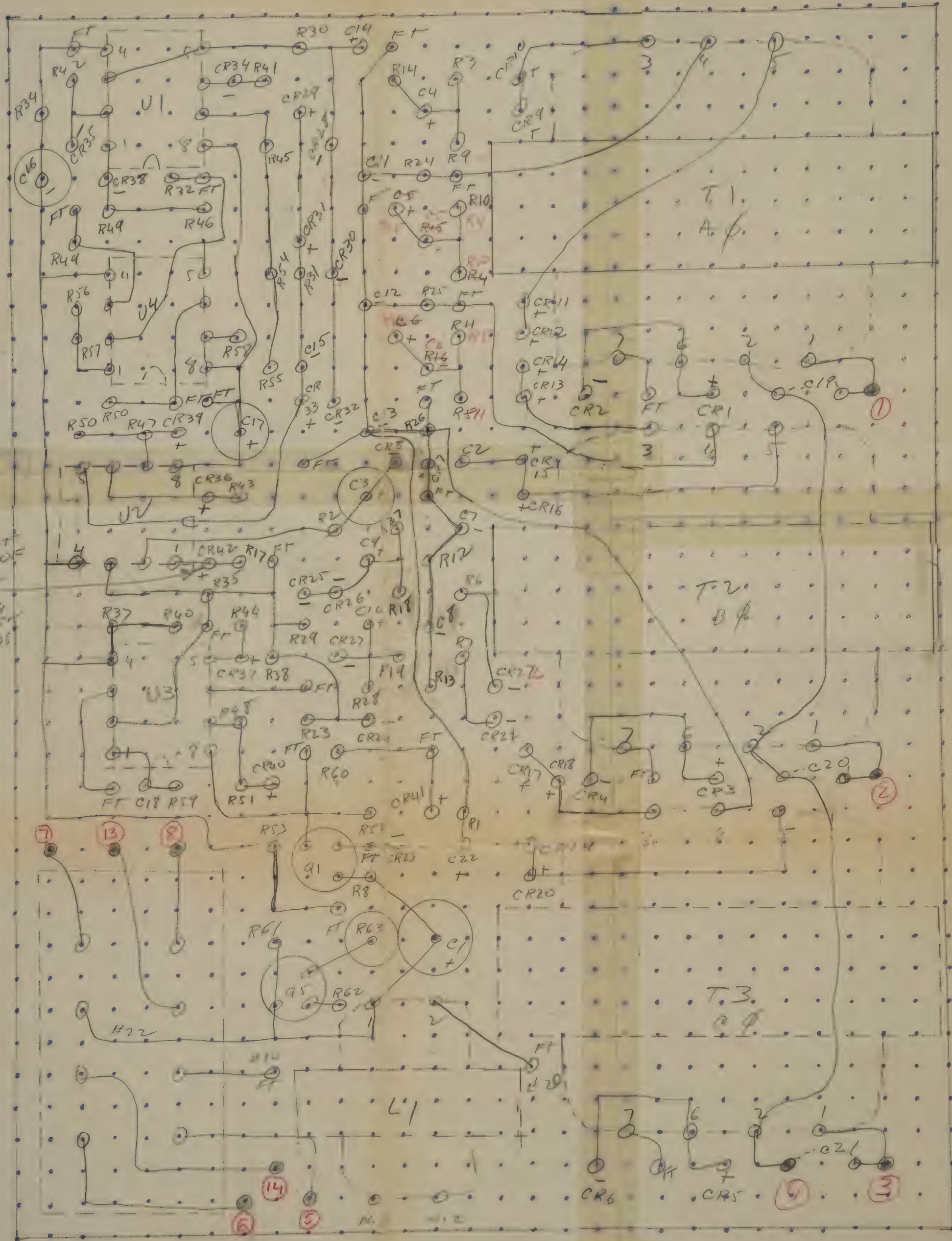
10 - yellow

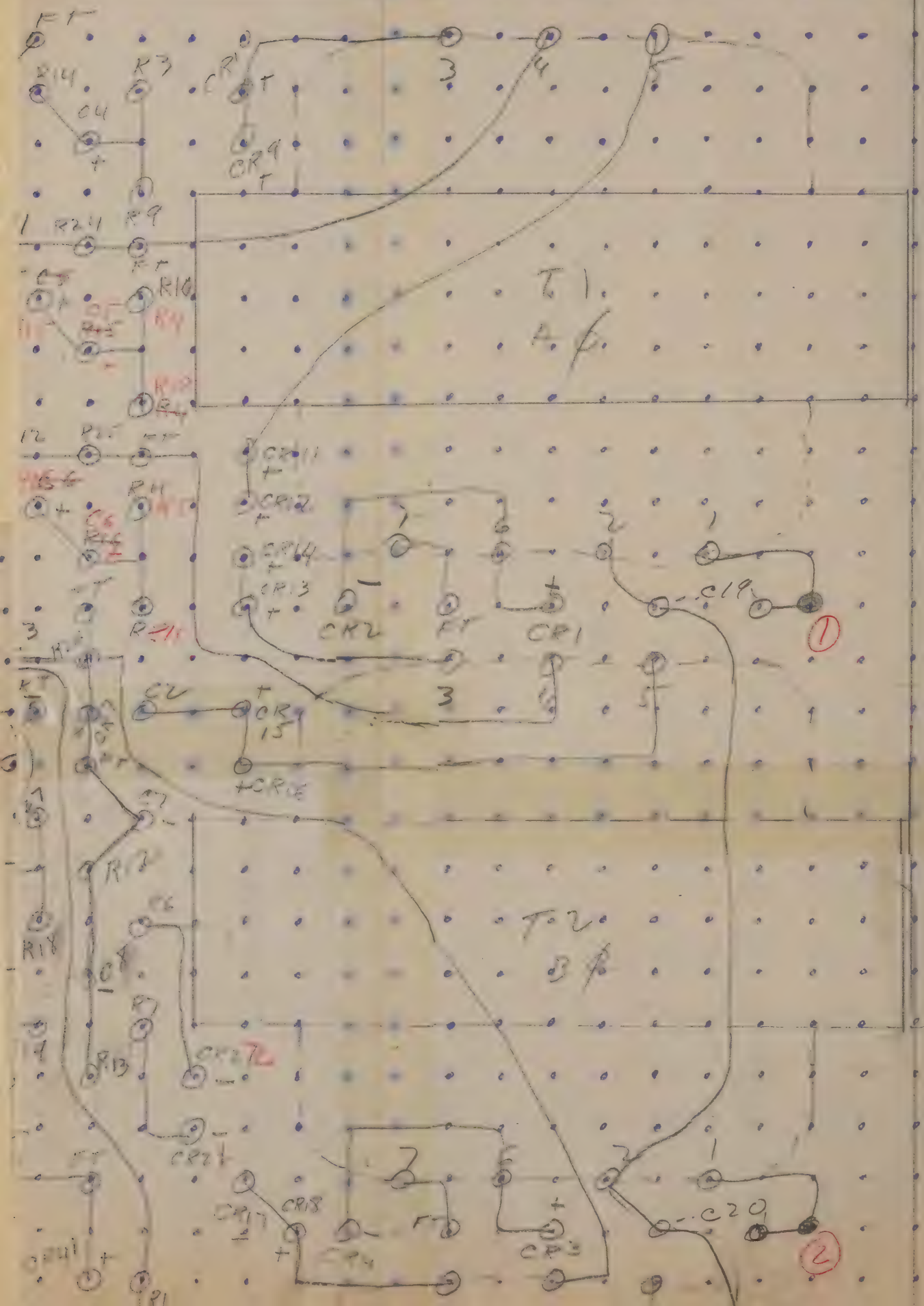
11 - brown

12 - red



CONNECT
- SIDE OF
CR42
TO R64
BETWEEN
BOARDS





ELECTRONICS COMPANY, INC.

1540 South Lyon

SANTA ANA

CALIFORNIA

92705

FINAL INSPECTION RECORD

DATE: _____

SHOP ORDER NO.

PARKO P/N: 101064 () Sensing Relay,
Over/Under Voltage

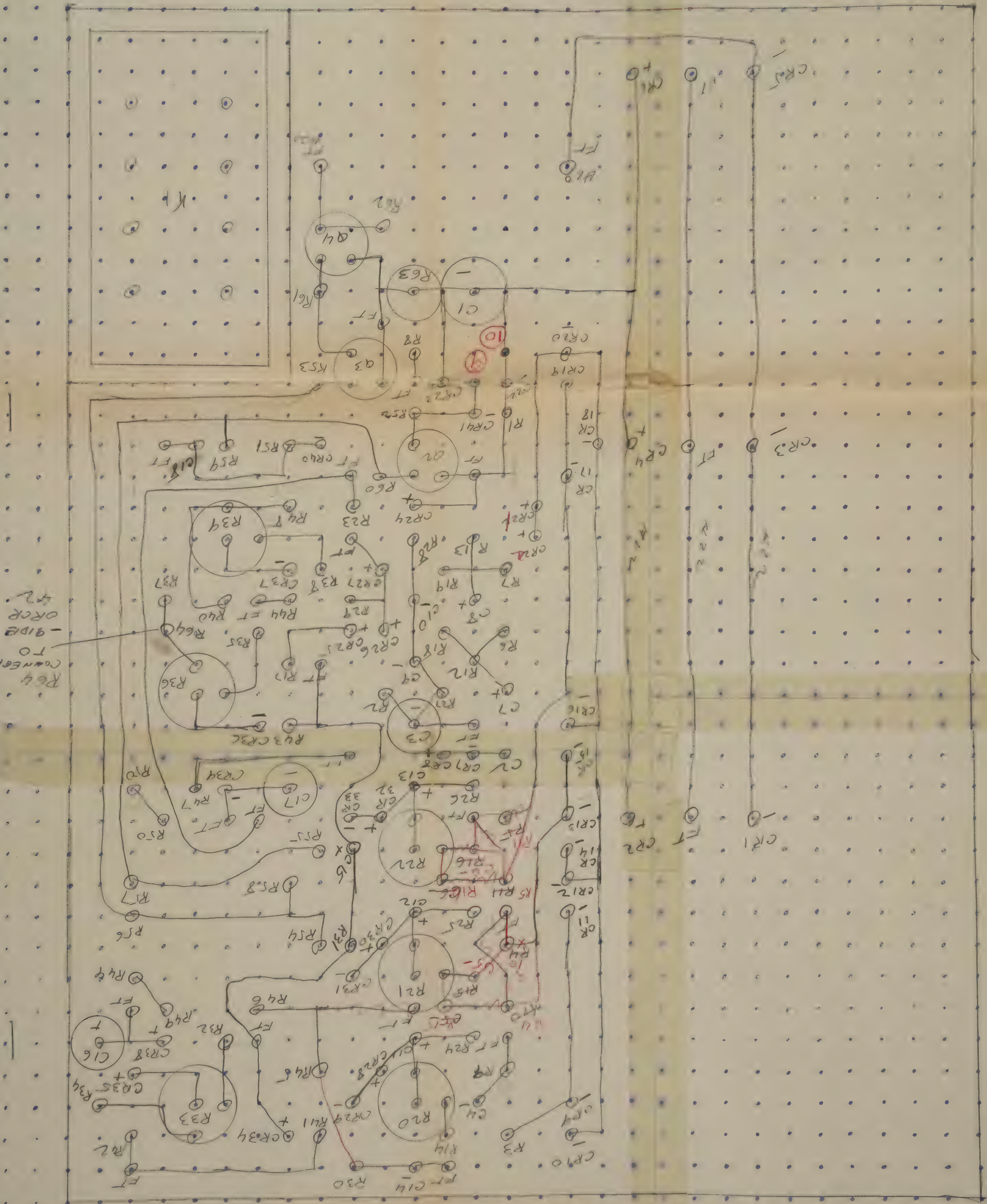
CUSTOMER P/N: 2938799-1 (C)

CUSTOMER & P.O. NO.:

APPLICABLE SPEC.: ES 912

[illegible]

101280 WIT. NO. 2
6/1/77



ELECTRONICS COMPANY, INC.

1540 South Lyon

SANTA ANA

CALIFORNIA

92705

FINAL INSPECTION RECORD

DATE:

SHOP ORDER NO.

PARKO P/N: 101064 () Sensing Relay,
Over/Under Voltage

CUSTOMER P/N: 2938799-1 (C)

CUSTOMER & P.O. NO.:

APPLICABLE SPEC.: ES 912

[illegible]

Parko

ELECTRONICS COMPANY, INC.

1540 South Lyon

SANTA ANA

CALIFORNIA

92705

FINAL INSPECTION RECORD

DATE:

SHOP ORDER NO.

PARKO P/N: 101064 () Sensing Relay Over/Under Voltage

CUSTOMER P/N: ~~2938799-1~~ (C)

CUSTOMER & P.O. NO.:

APPLICABLE SPEC.: ES 912

[illegible]

ELECTRONICS COMPANY, INC.

1540 South Lyon

SANTA ANA

CALIFORNIA

92705

FINAL INSPECTION RECORD

DATE: _____

SHOP ORDER NO.

101280 Sensing Relay
PARKO P/N: 101064 () Over/Under Voltage

CUSTOMER P/N: ~~2938799~~-1 (C)

CUSTOMER & P.O. NO.:

APPLICABLE SPEC.: ES 912

[illegible]

ELECTRONICS COMPANY, INC.

● SANTA ANA

CALIFORNIA

92705

FINAL INSPECTION RECORD

PARTO P/N: 101064 () Over/Under Voltage

CUSTOMER P/N: ~~2988799~~-1 (C)

APPLICABLE SPEC.: ES 912

[illegible]

Parko

ELECTRONICS COMPANY, INC.

1540 South Lyon

SANTA ANA

CALIFORNIA

92705

FINAL INSPECTION RECORD

DATE:

SHOP ORDER NO.

PARKO P/N:

101084

Sensing Relay Over/Under Voltage

CUSTOMER P/N:

2938799-1 (C)

CUSTOMER & P.O. NO.:

APPLICABLE SPEC.: ES-912

[illegible]

Parko

ELECTRONICS COMPANY, INC.

1540 South Lyon

SANTA ANA

CALIFORNIA

92705

FINAL INSPECTION RECORD

DATE: _____

SHOP ORDER NO.

101064 Sensing Relay
PARKO P/N: 101064 () Over/Under Voltage

CUSTOMER P/N: ~~2938799-1~~ (C)

CUSTOMER & P.O. NO.:

APPLICABLE SPEC.: ES 912

Trip Points - Relay Contacts Transfer						
Serial Number	Limit 1			Limit 2		
	Phase C			Phases A B C		
	Trip Point	Fault Output	Reset	Trip Point	Fault Output	Reset
	131.5 VAC + 1 V	0.5 VDC Max	1 V Max	129.5 VAC + 1 V	0.5 VDC Max	1 V Max
1	103.4	✓	104.4	105.82	—	106.9
2	103.88	—	104.84	105.78	—	106.8
3	103.80	—	105.18	106.14	—	107.16
4	103.72	✓	105.07	105.74		107.00
SERIAL #31 REPAIRED 3/14/75						
#3	104.1	3.5	105.2	106.0	3.5	107.1
#1	103.3	3.5	104.2	105.9	3.0	106.0

FINAL INSPECTION RECORD

DATE: _____

SHOP ORDER NO.

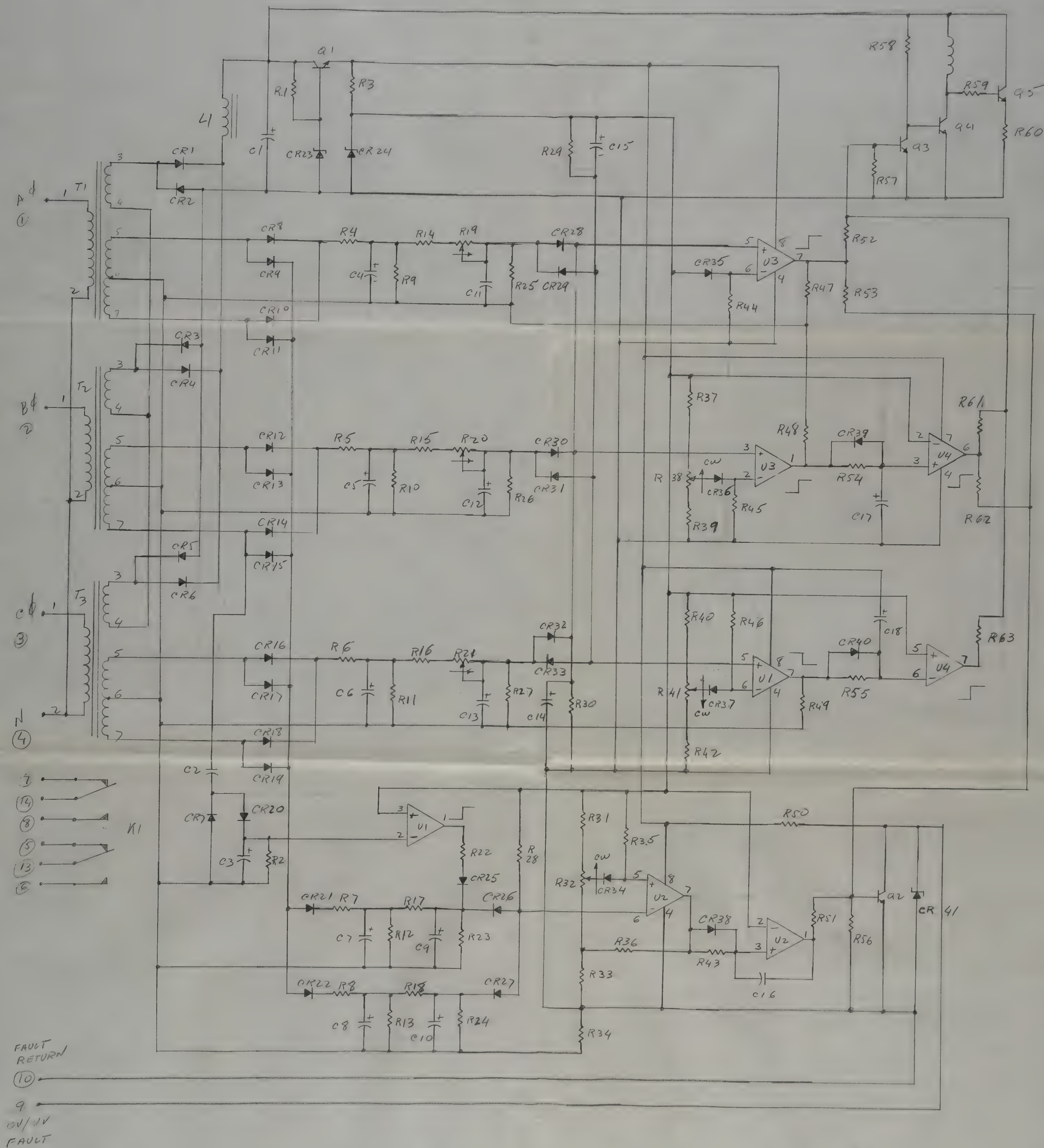
PARKO P/N: 101064 () Over/Under Voltage

CUSTOMER P/N: 2938799-1 (C)

CUSTOMER & P.O. NO.:

APPLICABLE SPEC.: ES 912

[illegible]



101280 10/17/74 (old Ref Des)

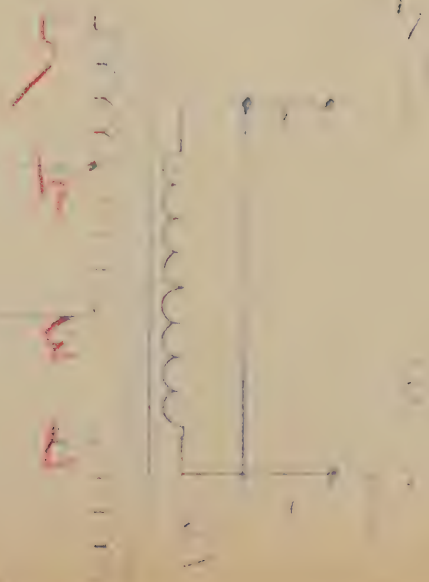
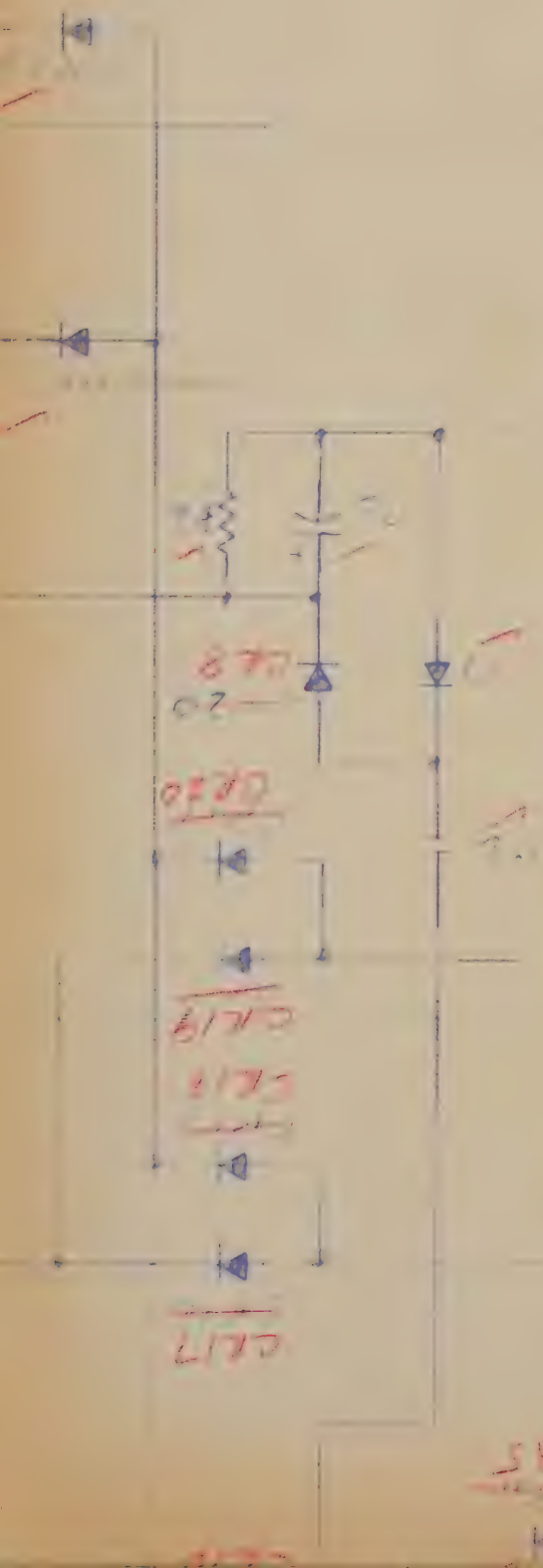


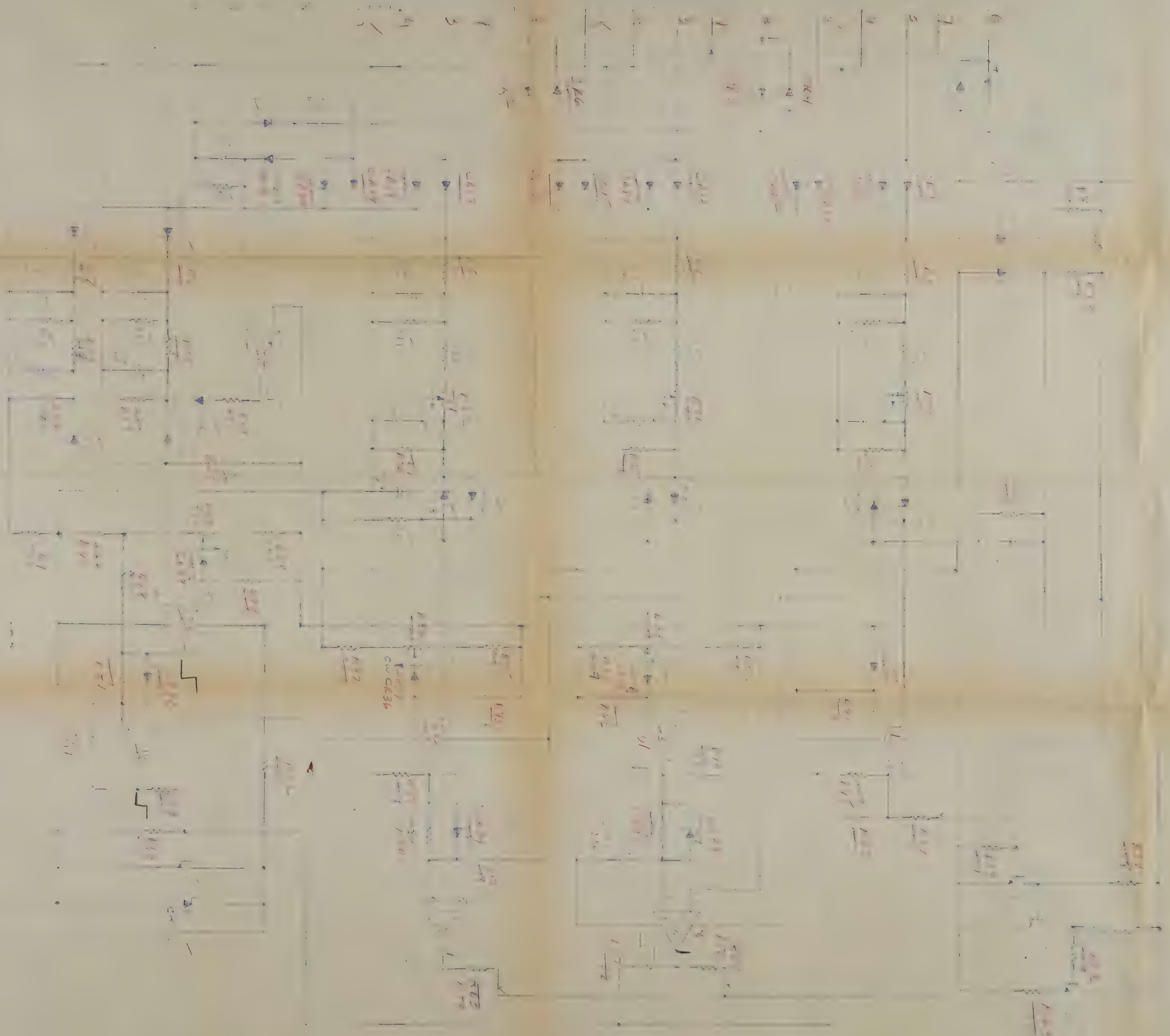
CH-106

R40 TO 7.54

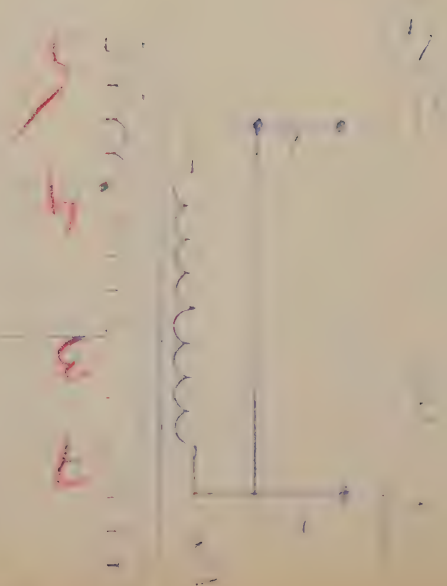
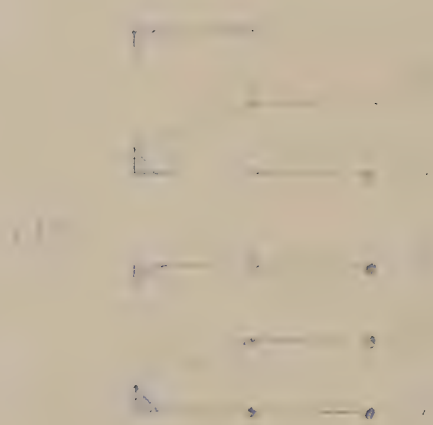
R48 TO 82.24

4-20-75





6.2.11/11
11



6010 = 5/2
EVALUATION

10180

REVIEW 3120PS

1100PS - 1100PS

WIRE LINE METHOD

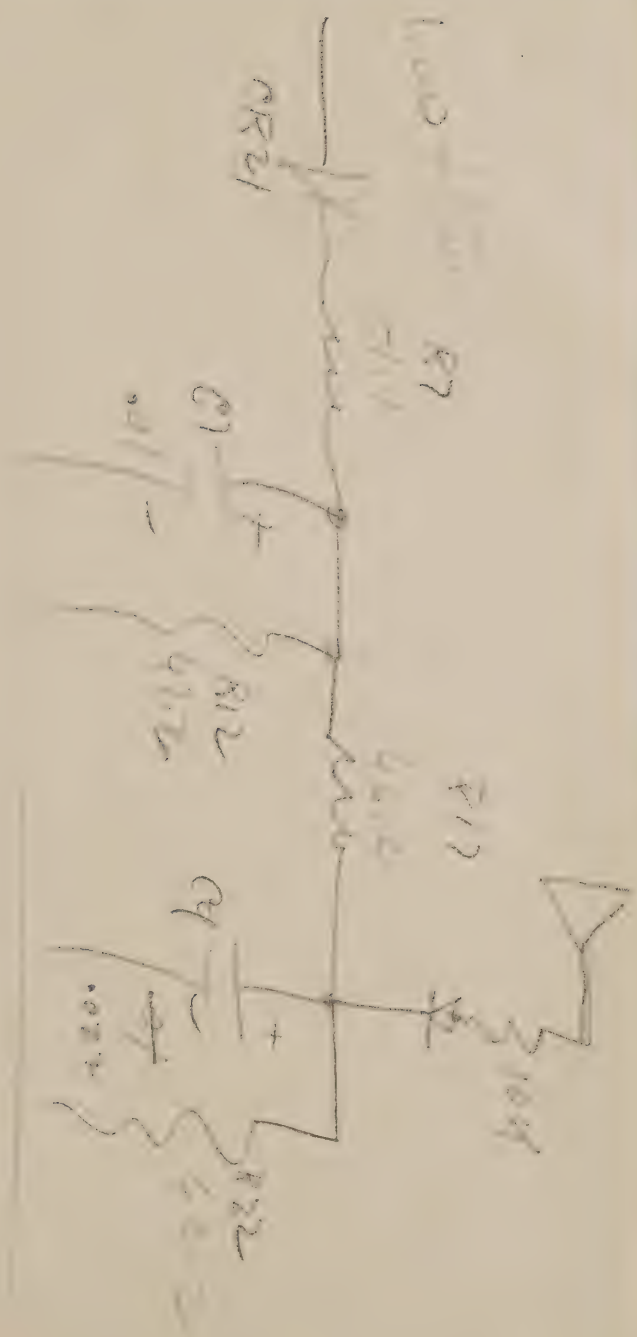
PROPS 8-10V OUTS

3129A - 00325

75 - 10180

NE

120 - 338 2-11







101280

X former dimensions

1.7

$1\frac{3}{8}$ L X $1\frac{1}{8}$ H $1\frac{1}{8}$ W

$\frac{3}{4}$ X $\frac{5}{8}$ X $\frac{5}{8}$

.3

$\frac{3}{8}$ X $\frac{1}{2}$

STACK

LAMIN.

$1\frac{1}{3}$

X $1\frac{1}{8}$

1" coll

$1\frac{5}{8}$

$1\frac{5}{16}$

Our party last summer was so e
included - that we decided to hav
again meet with Andy and have hi
experiences and opinions of life i
individually with us.

So, please come to our house on
open bar and something to munch

Sincerely,

Frank and B.J. Parker

Where:

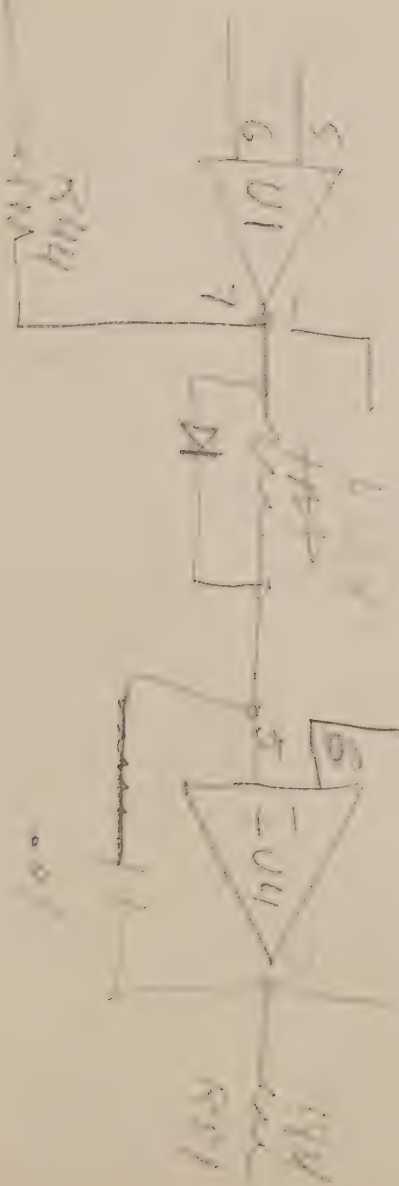
1402 Lansdowne Lar
Santa Ana, CA 9270

When:

6-8 P.M. August 24

PLEASE COME!

U1



~~10k~~
10k

$$\frac{1}{2} \frac{1}{2} \frac{1}{2}$$

$$\frac{1}{2} \frac{1}{2} \frac{1}{2}$$

$$\frac{1}{2} \frac{1}{2} \frac{1}{2}$$

Since 48 CT 2.14

22 100TS 15.14

USC $\frac{3}{8}$ & $\frac{3}{8}$

X FDR 11.11

11.11.11

EDDIE SAID

GO H2 FAVOR OF WNS
MEMSURED AT NUMBER 10

BE 4.5 MS

TRIP EXPECTED 10 W TRIP START
AT 6042 OUT OF TOWER RANGE

SOMEWHERE AROUND 1000

ADDED A LITTLE BIAS VOLTAGE
FROM V2-1 (WHEN AT 6042) TO TOP
OF R37 (RESISTOR 2.0000 - 1214)

6042 LOW TRIP 103.0

4-24-25

10/28/0

4/28/75

CHECKED 60 Hz line TRIP POINT
WITH A Φ AND 8 Φ OPEN. D.C. POWER
EXTERNALLY APPLIED 27V AT Q1. COIL.

4.65 VDC EXTERNALLY APPLIED TO
R24 & R25. 60 Hz APPLIED TO COIL

ADDED DIODE AND 1214 RESISTOR FROM

02-1 TO TOP OF R37

LOADED POWER WINDING OF T3 WITH

420 Ω

16' ✓ 250V $Q=48$

150V 118 MS

125V 114 MS

100V 98

75V 82

50V 66

25V 36 MS

12V 120

6V 108 MS

FILTER

DECAY

MSAC

9/9/75

Remember...
MINUTEMAN PRESS

101280 + 101523


BR 194-900 E 1-26 V
≡

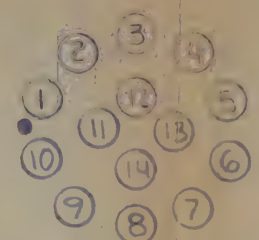


(714) 751-3500

21. CUSTOMER PART NO: 719710-1
20. FINISH: TIN PLATE PER MIL-T-10727A
19. WEIGHT: 0.02 OZ MAX
18. INSULATION RESISTANCE: 100 MEGOHMS MIN AT 500 VDC. PINS TO CASE.
17. DIELECTRIC STRENGTH: 1000 VRMS MIN AT 60 HZ. PINS TO CASE.
16. VIBRATION: 20 G'S, 10-2000 HZ, 10 G'S, 10-500 HZ.
15. SHOCK: 100 G'S FOR 6 MS.
14. TEMPERATURE RANGE: 0°C TO +71°C.
13. CONTACT RATING: 5 AMPS RESISTIVE, 2 AMPS INDUCTIVE @ 30 VDC OR 115 VAC.
12. MISSING PHASE: RELAY DROPS OUT IF ANY PHASE IS REMOVED. TRIP TIME DELAY 5 SECONDS \pm 10%.
11. DROPOUT VOLTAGE: 45 VAC MAX, 3 PHASE.
10. PULL IN VOLTAGE: 90 VAC MAX, 3 PHASE.
9. LOW VOLTAGE TRIP POINT #3: FAULT OUTPUT DELAY WITH ALL 3 PHASES GOING SIMULTANEOUSLY TO 75 ± 5 VAC SHOULD BE 1 MS MAX AT 400 HZ OR 6 MS MAX AT 60 HZ. RESET 2 MS MAX.
8. LOW VOLTAGE TRIP POINT #2: 104.5 ± 2 VAC 3 PHASES SIMULTANEOUSLY. FAULT OUTPUT IS + 0.5 VDC MAX. RELAY REMAINS ENERGIZED IF THE EXCURSION TIME IS LESS THAN 4.5 SEC.
7. LOW VOLTAGE TRIP POINT #1: $103.5 \pm 3, -1$ VAC SINGLE OR 3 PHASE WITH 5 SEC \pm 10% RELAY DELAY. RELAY DROPS OUT. RESET DIFFERENTIAL 2 VAC MAX.
6. HIGH VOLTAGE TRIP POINT #2: 101 ± 2 VAC SINGLE PHASE WITH 150 MS MAX RELAY DELAY, RELAY DROPS OUT & FAULT OUTPUT IS + 0.5 VDC MAX.
5. HIGH VOLTAGE TRIP POINT #1: $129.5 \pm 1, -1$ VAC SINGLE PHASE OR 129.5 ± 1 V 3 PHASES SIMULTANEOUSLY WITH 1 SEC \pm 10% RELAY DELAY. RELAY DROPS OUT & FAULT OUTPUT IS + 0.5 VDC MAX.
4. NOMINAL OPERATION: RELAY IS ENERGIZED AND FAULT OUTPUT IS + 5.5 \pm 1 VDC.
3. FAULT OUTPUT: 3 MS MIN PULSE WIDTH WITH RISE AND FALL TIMES OF LESS THAN 0.1 MS. TTL COMPATIBLE, 1K MAX INTERNAL IMPEDANCE CAPABLE OF SUPPLYING 1 MA MIN AT $+ 3.5 \pm 1$ VDC AND SINKING 10 MA MIN AT + 0.5 VDC MAX.
2. INPUT/OUTPUT ISOLATION: 50 K MIN BETWEEN TERMINAL 10 AND TERMINALS 1, 2, 3 AND 4.
1. POWER INPUT: NOMINAL 120 VAC \pm 5 - 10%, 50, 60 OR 400 HERTZ, 3 PHASE 4 WIRE, 1 K MIN INPUT IMPEDANCE. OPERATING RANGE 0 TO 175 VAC, 47.5 TO 420 HERTZ.

SPECIFICATIONS:

DIMENSIONS ARE IN INCHES AND AFTER PLATING TOLERANCES (unless otherwise specified) .X \pm .1 .XX \pm .03 .XXX \pm .010 ANGLES \pm 0.5° MACH SURF <input checked="" type="checkbox"/>	DR <i>C. J. Miller</i> 7-15-74	 ELECTRONICS COMPANY INC. SANTA ANA, CALIF.		
	CHK <i>C. J. Miller</i> 11-26-74			
	DSGN <i>C. J. Miller</i> 1-20-74	SENSING RELAY OVER-UNDER VOLTAGE		
	PROJ			
	REL <i>C. J. Miller</i> 12-1-74			
APPROVED <i>C. J. Miller</i> 1-22-74	CODE IDENT NO.	SIZE	REV	
APPROVED <i>C. J. Miller</i> 1-22-74	13979	B	101280	
DO NOT SCALE DRAWING	SCALE 1:1	SHEET 1 OF 1		



PIN CONNECTIONS

- 1 0 A
- 2 0 B
- 3 0 C
- 4 NEUTRAL
- 5 KI-A3 (NO)
- 6 KI-A1 (NO)
- 7 KI-B3 (NO)
- 8 KI-B1 (NO)
- 9 CV/OV FAULT
- 10 FAULT RESET
- 11 CASE GROUND
- 12 NOT USED
- 13 KI-A2 (ARM)
- 14 KI-B2 (ARM)

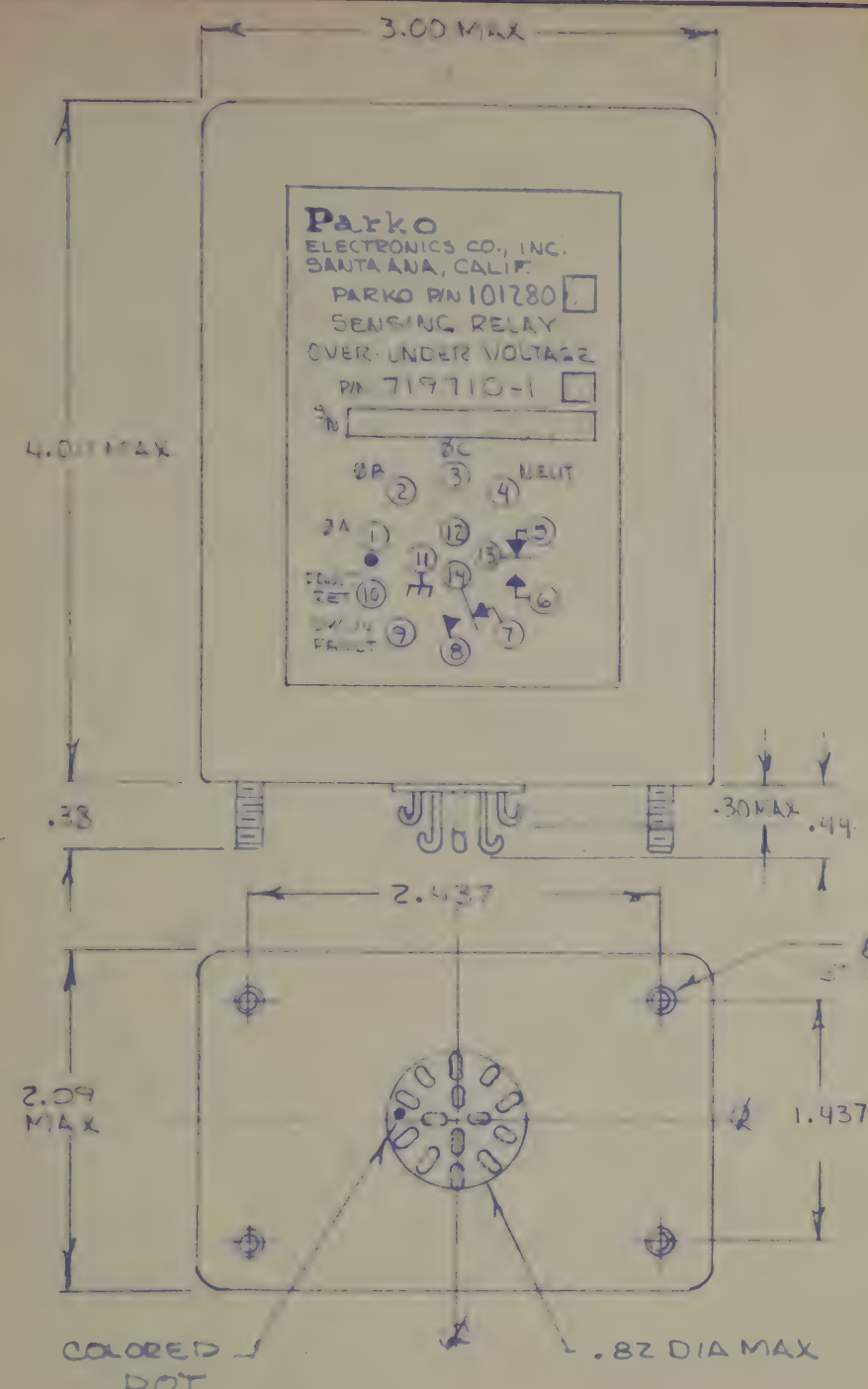
SERIAL NO IDENTIFICATION

S/N XXXX XXXX XXXX
 YEAR (LAST 2 DIGITS)
 WEEK (WITHIN THE YEAR)
 ITEM (WITHIN THE WEEK)
 SHOP ORDER No.

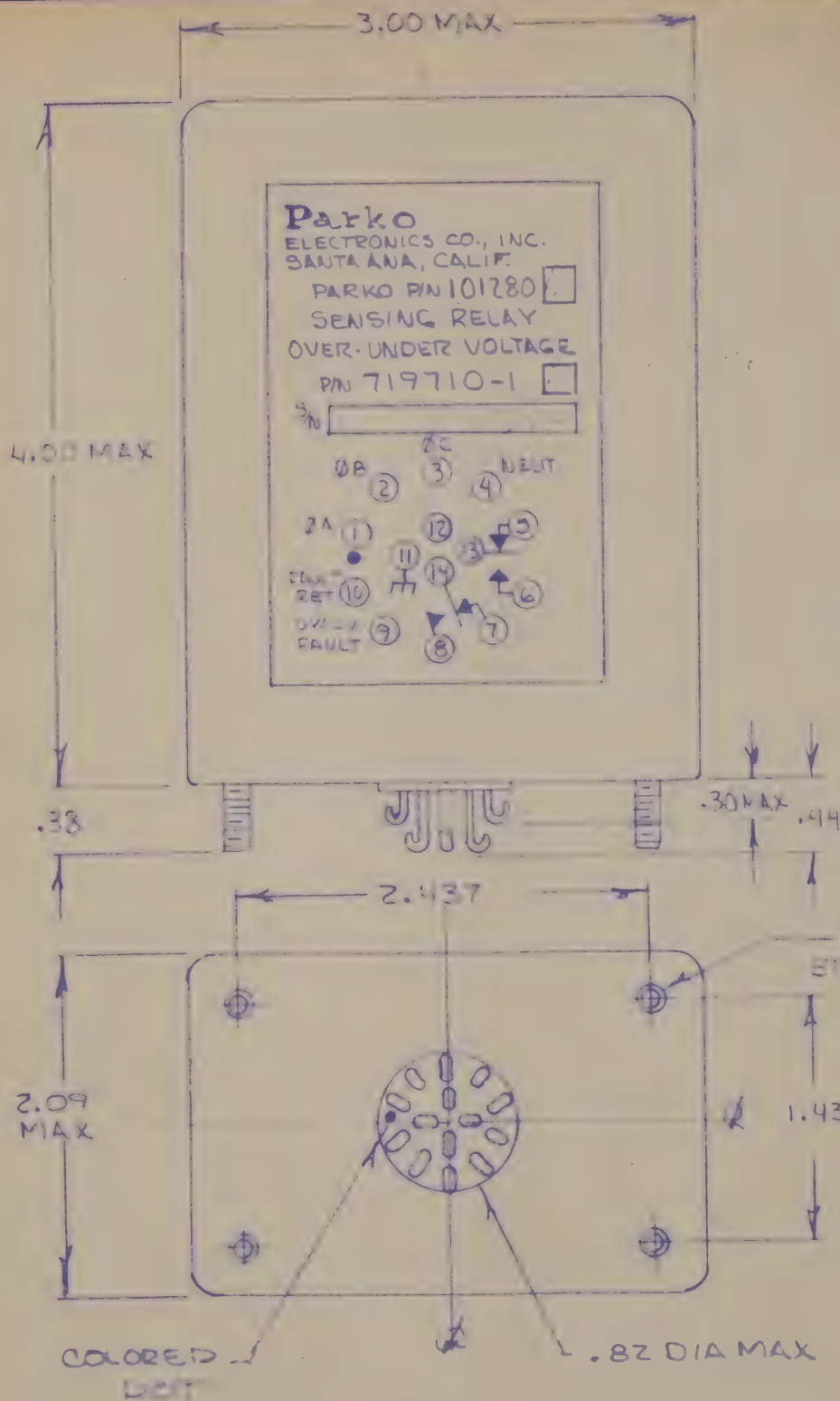
21. CUSTOMER PART NO: 719710-1
20. FINISH: TIN PLATE PER MIL-T-10727A
19. WEIGHT: 32 OZ MAX
18. INSULATION RESISTANCE: 100 MEGOHMS MIN AT 500 VDC. PINS TO CASE.
17. DIELECTRIC STRENGTH: 1000 V RMS MIN AT 60 HZ. PINS TO CASE.
16. VIBRATION: 20 G'S, 10-2000 HZ, 10 G'S, 10-500 HZ.
15. SHOCK: 100 G'S FOR 6 MS.
14. TEMPERATURE RANGE: 0°C TO +71°C.
13. CONTACT RATINGS: 5 AMPS RESISTIVE, 3 AMPS INDUCTIVE @ 250 VDC OR 115 VAC.
12. MISSING PHASE: RELAY DROPS OUT IF ANY PHASE IS REMOVED. TRIP TIME DELAY 5 SECONDS \pm 10%.
11. DROPOUT VOLTAGE: 85 VAC MAX, 3 PHASE.
10. PULL IN VOLTAGE: 90 VAC MAX, 3 PHASE.
9. LOW VOLTAGE TRIP POINT #3: FAULT OUTPUT DELAY WITH ALL 3 PHASES GOING SIMULTANEOUSLY TO 75 \pm 5 VAC SHOULD BE 1 MS MAX AT 400 HZ OR 6 MS MAX AT 60 HZ. RESET 7 MS MAX.
8. LOW VOLTAGE TRIP POINT #2: 104.5 \pm 2 VAC 3 PHASES SIMULTANEOUSLY, FAULT OUTPUT IS + 0.5 VDC MAX. RELAY REMAINS ENERGIZED IF THE EXCURSION TIME IS LESS THAN 4.5 SEC.
7. LOW VOLTAGE TRIP POINT #1: 103.5 \pm 3, -1 VAC SINGLE OR 3 PHASE WITH 5 SEC \pm 10% RELAY DELAY. RELAY DROPS OUT. RESET DIFFERENTIAL 2 VAC MAX.
6. HIGH VOLTAGE TRIP POINT #2: 141 \pm 2 VAC SINGLE PHASE WITH 100 MS MAX RELAY DELAY, RELAY DROPS OUT & FAULT OUTPUT IS + 0.5 VDC MAX.
5. HIGH VOLTAGE TRIP POINT #1: 139.5 \pm 2, -1 VAC SINGLE PHASE OR 3 PHASES SIMULTANEOUSLY WITH 5 SEC \pm 10% RELAY DELAY. RELAY DROPS OUT & FAULT OUTPUT IS + 0.5 VDC MAX.
4. NOMINAL OPERATION: RELAY IS ENERGIZED AND FAULT OUTPUT IS + 3.9 \pm 1 VDC.
3. FAULT OUTPUT: 3 MS MIN PULSE WIDTH WITH RISE AND FALL TIMES OF LESS THAN 0.1 MS. TTL COMPATIBLE, 1K MAX INTERNAL IMPEDANCE CAPABLE OF SUPPLYING 1 MA MIN AT + 3.5 \pm 1 VDC AND SINKING 10 MA MIN AT + 0.5 VDC MAX.
2. INPUT/OUTPUT ISOLATION: 50 K MIN BETWEEN TERMINAL 10 AND TERMINALS 1, 2, 3 AND 4.
1. POWER INPUT: NOMINAL 120 VAC \pm 5 - 10%, 50, 60 OR 400 HERTZ, 3 PHASE 4 WIRE, 1 K MIN INPUT IMPEDANCE. OPERATING RANGE 0 TO 175 VAC, 47.5 TO 420 HERTZ.

SPECIFICATIONS:

DIMENSIONS ARE IN INCHES AND AFTER PLATING TOLERANCES (unless otherwise specified) X \pm .1 XX \pm .03 XXX \pm .010 ANGLES \pm 0.5° MACH SURF <input checked="" type="checkbox"/>	DR <i>Ch. Daniel</i> 8-15-74	<div style="text-align: center;"> Parko ELECTRONICS COMPANY INC. SANTA ANA, CALIF. </div> <div style="text-align: center; font-size: 1.2em;"> SENSING RELAY- OVER-UNDER VOLTAGE </div>	CODE IDENT NO.		SIZE	REV	
	CHK <i>A. Lucas</i> 11-26-74		13979		B	101280	
	DSGN <i>Ch. Daniel</i> 8-15-74						
	PROJ <i>Ch. Daniel</i> 8-15-74						
	REL <i>Ch. Daniel</i> 12-1-74						
	APPROVED <i>Ch. Daniel</i> 11-27-74						
	APPROVED <i>Ch. Daniel</i> 11-27-74						
DO NOT SCALE DRAWING	SCALE 1:1	SHEET 1 OF 1					



2 ASSEMBLY: 101282
 1 B-M F SCHEMATIC: 101281
 NOTES



PIN CONN

1	Ø A
2	Ø B
3	Ø C
4	NEUTRAL
5	KI-23 (N)
6	KI-A1 (N)
7	KI-B3 (N)
8	KI-B1 (N)
9	OV/UV F
10	FAULT R
11	CASE GR
12	NOT USE
13	KI-AZ (N)
14	KI-BZ (N)

2 ASSEMBLY: 101282

1 B.M.Y SCHEMATIC: 101281

NOTES:

Parko

ELECTRONICS COMPANY, INC.

1540 South Liver

SANTA ANA

CALIFORNIA

92705

FINAL INSPECTION RECORD

DATE:

5/24/77

SHOP ORDER NO.

PARKO P/N: 101280 ()

Sensing Relay,
Over/Under Voltage

CUSTOMER P/N: 719710-1 ()

CUSTOMER & P.O. NO.:

APPLICABLE SPEC.:

Serial Number	Dielectric Strength All Pins Except #11 To Case 1000 VRMS 60 HZ	Insulation Resistance All Pins Except #11 To Case 1000 Meg 500 VDC	Input to Output Isolation Pin 10 to Pins 1,2&3		Relay Contacts Isolation Pins 5, 6, 7, 8, 13, 14 To All Other Pins	
			500 VRMS 60 HZ	1000 Meg 100 VDC	500 VRMS 60 HZ	1000 Meg 100 VDC

S/N = 3271 A0071576 (FROM EXORDIAN)

CHANGED TO 3271 A0072177

400 HZ - NO FALSE TRIP ON
RELAY OR FAULT AS ONE
PHASE IS INTERRUPTED OR MADE
NOISY. - NO NOISE OR H.F.
RIPPLE ON OP-AMP.

60 HZ - NO FALSE TRIP AS
ABOVE.

REACHING GROUNDS - MOVE C14, R30
GROUND - AD CAPS TO TRANSFORMER
101/400V - ADD 1UF/35 AOMPOS
R10

Parko

ELECTRONICS COMPANY INC

1540 South Lyon

SANTA ANA

CALIFORNIA

FINAL INSPECTION RECORD

DATE:

SHOP ORDER NO.

FARKO P/N: 101250 () Over/Under Voltage

CUSTOMER P/N: 71 710-1

CUSTOMER & P.O. NO.:

APPLICABLE SPEC.: FS 081

[illegible]

1540 South Lyon

CALIFORNIA

92709

FINAL INSPECTION RECORD

SHOP ORDER NO.

Sensing Relay

FAK0 P/N: 101200 () Over/Under Voltage

CUSTOMER P/N: 710710-1

CUSTOMER S. P. O. NO.:

APPLICABLE SPEC. FC 1

[illegible]

Parko

ELECTRONICS COMPANY INC.

1545 South Lyon

SANTA ANA

CALIFORNIA

92705

FINAL INSPECTION RECORD

DATE:

SHOP ORDER NO.

PARKO P/N: 1-12-0

Timing Relay

Overload Voltage

CUSTOMER P/N: 73-710-1

CUSTOMER & P.O. NO.:

APPLICABLE SPEC.: ES 981

Trip Points - Relay Contacts Transfer

Limit 1

Limit 2

Phase A

Phase B

Serial Number

Trip Point
150.0 VDC
± 1 V

Fault Output
1.5 VDC
Max

Reset
Differential
2 V Max

Trip Point
150.0 VDC
± 1 V

Fault Output
1.5 VDC
Max

Reset
Differential
2 V Max

400

162.9

.02

162.3

162.8 ✓

.0 ✓

162.2

0

160.5

.02

160.1

161.0

.02

160.7

400

161.0

161.0



ELECTRONICS COMPANY, INC.

1540 South Lyon

SANTA ANA

CALIFORNIA

92705

FINAL INSPECTION RECORD

DATE: _____

SHOP ORDER NO.

PARKO P/N:

Sensing Relay
1) Over/Under Voltage

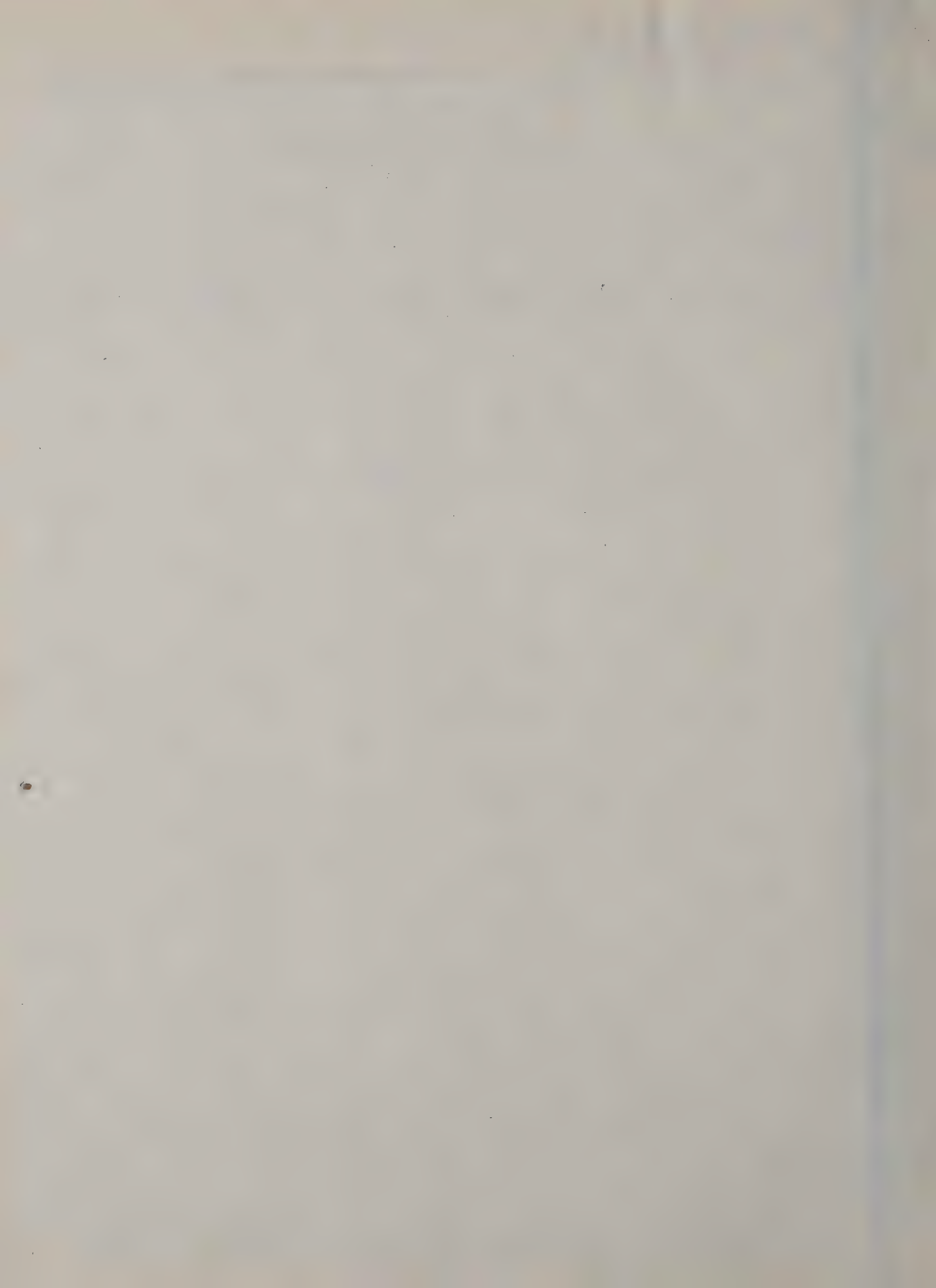
CUSTOMER P/N: 710710-

CUSTOMER & P.O. NO.:

APPLICABLE SPEC.:

031

1.110			
	Phase		
Output	Output	Output	Reset
1000	0.5 VDC	1000	1000
Max	Max	Max	Max
162.8	0.02	162.1	
161.4	0.02	161.0	
161.2			



Parlo

ELECTRONICS COMPANY INC

1540 South Lyon

SANTA ANA

CALIFORNIA

92705

FINAL INSPECTION RECORD

NAME:

SHOP ORDER NO.

PARKO P/N: 101230

Sensing Relay Over/Under Voltage

71-71-1

CUSTOMER & P.O. NO.:

APPLICABLE SPEC.: ES 981

[illegible]

Parko

ELECTRONICS COMPANY, INC.

1540 South Lyon

SANTA ANA

CALIFORNIA

92705

FINAL INSPECTION RECORD

DATE:

SHOP ORDER NO.

Sensing Relay

PARKO P/N: 101280 () Over/Under Voltage

CUSTOMER P/N: 719710-1

CUSTOMER & P.A. NO.:

APPLICABLE SPEC.: ES 981

Trip Points - Relay Contacts Transfer

Serial Number	Limit 3 Phase C			Limit 3 Phases A B C	
	Trip Point 103.5 VAC ± 1 V	Fault Output 3.5 VDC ± 1 V	Reset Differential 2 V Max	Trip Point 103.5 VAC ± 2 V	Reset Differential 2 V Max

400	103.5V	3.44	104.7	105.5	106.8
60	104.0	3.40	104.8		
00	103.3	3.45	104.3		
400	102.9	3.45	104.0	105.4	106.7

Parko

ELECTRONICS COMPANY INC

1540 South Lyon

SANTA ANA

CALIFORNIA

92705

FINAL INSPECTION RECORD

DATE:

SHOP ORDER NO.

PARKO P/N:

Sensing Relay
Over/Under Voltage

CUSTOMER P/N: 719710-1

CUSTOMER P.C. NO.:

APPLICABLE SPEC.:

9811

Serial

Trip Point

Fault Output
0.5 VDC
Max

Differential

Test Result

400
600
103.8

0.02

100.0

3.40

103.8

0.02

104.5

3.00

Parko

ELECTRONICS COMPANY, INC.

1540 South Lyon

SANTA ANA

CALIFORNIA

92705

FINAL INSPECTION RECORD

DATE:

SHOP ORDER NO.

PARKO P/N:

Sen in; Relay
Over/Under Voltage

CUSTOMER P/N: 710710-1

CUSTOMER S.P.O. NO.:

APPLICABLE SPEC.: PS 21

Serial Number	Timing L1 - P 3		
	1 to 135VAC 0 ± .2 seconds	1 to 170VAC 150 ms max	
200	1.98	115MS	5.01
60	2.18		5.06
			1.5MS N.T.T. SUPPLY DECA
60	2.04		4.99
200	2.03	101MS	5.01

4	5
u	1
0	8

0	0
u	4
0	0

5	8
u	2
1	1

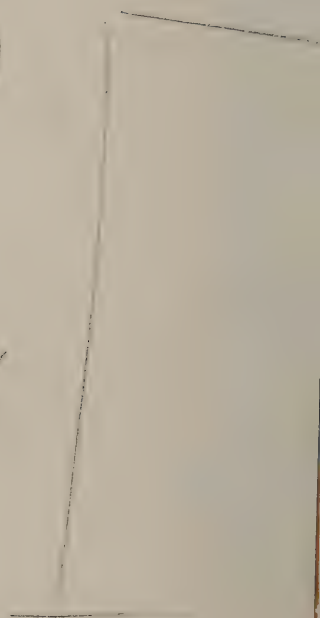
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3	8
0	8

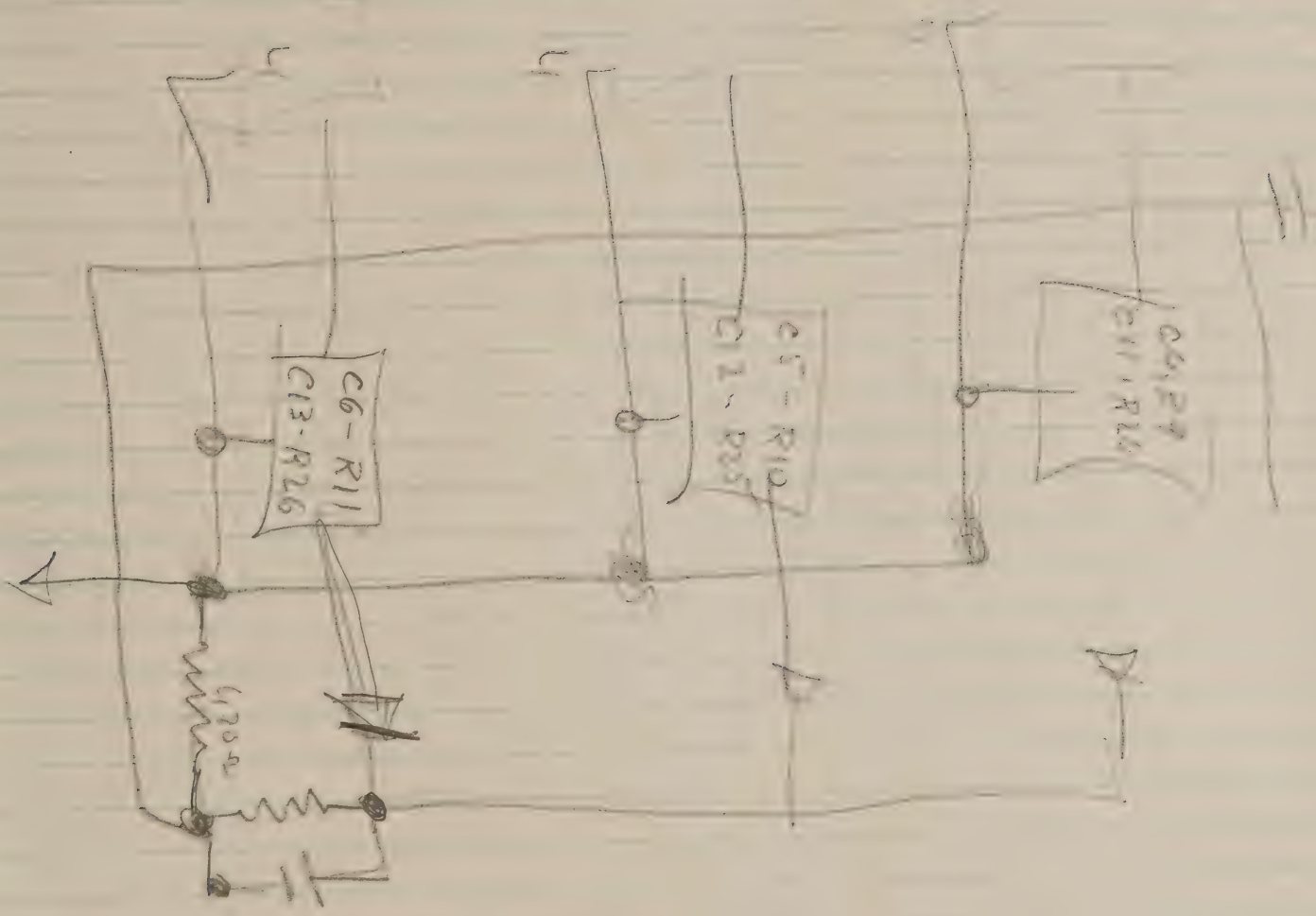
0	0
0	0
0	0

(95)

93

Q94





45
46



Parko

ELECTRONICS COMPANY, INC.

1540 South Lyon

SANTA ANA

CALIFORNIA

FUNCTIONAL INSPECTION RECORD

DATE:

SHOP ORDER NO.

PARKO P/N: ~~XXXXXXXXXX~~) Sensing Relay,
Over/Under Voltage

CUSTOMER #/N 2338799-1(C)

CUSTOMER & P.O. NO.:

APPLICABLE SPEC.: ES-911

[illegible]

Parko

ELECTRONICS COMPANY, INC.

1540 South Lyon

© SANTA ANA

CALIFORNIA

92705

FUNCTIONAL INSPECTION RECORD

DATE:

SHOP ORDER NO.

PARKO P/N: ~~101064 ()~~ Sensing Relay Over/Under Voltage

CUSTOMER P/N: ~~2938799-1(O)~~

CUSTOMER & P.O. NO.:

APPLICABLE SPEC.: ~~ES 911~~

[illegible]

Parko

ELECTRONICS COMPANY, INC.

1540 South Lyon

SANTA ANA

CALIFORNIA

92705

FUNCTIONAL INSPECTION RECORD

DATE:

SHOP ORDER NO.

PARKO P/N:

PARKO P/N: 101084 () Sensing Relay Over/Under Voltage

CUSTOMER P/N:

CUSTOMER & P.O. NO.:

APPLICABLE SPEC.: ~~ES 911~~[illegible]

Parko

ELECTRONICS COMPANY, INC.

1540 South Lyon

SANTA ANA

CALIFORNIA

92705

FUNCTIONAL INSPECTION RECORD

DATE: _____

SHOP ORDER NO.

101232 Sensing Relay
PARKO P/N: ~~101064~~ () Over/Under Voltage

CUSTOMER P/N: 2938799-1(C)

CUSTOMER & P.O. NO.:

APPLICABLE SPEC.: ~~ES 911~~

[illegible]

92705

APPLICABLE SPEC.: ~~ES 911~~

3-14-73

Parko

ELECTRONICS COMPANY, INC.

1540 South Lyon

SANTA ANA

CALIFORNIA

92705

FUNCTIONAL INSPECTION RECORD

DATE: _____

SHOP ORDER NO.

PARKO P/N: ~~101064~~ () Over/Under Voltage Sensing Relay

CUSTOMER P/N: ~~2988799-1~~ (C)

CUSTOMER & P.O. NO.:

APPLICABLE SPEC.: ES-911

[illegible]

FT

7 6

C16

13

8

5

Q

R5

$\left| + \right| R34$

C16

T

4

5

0

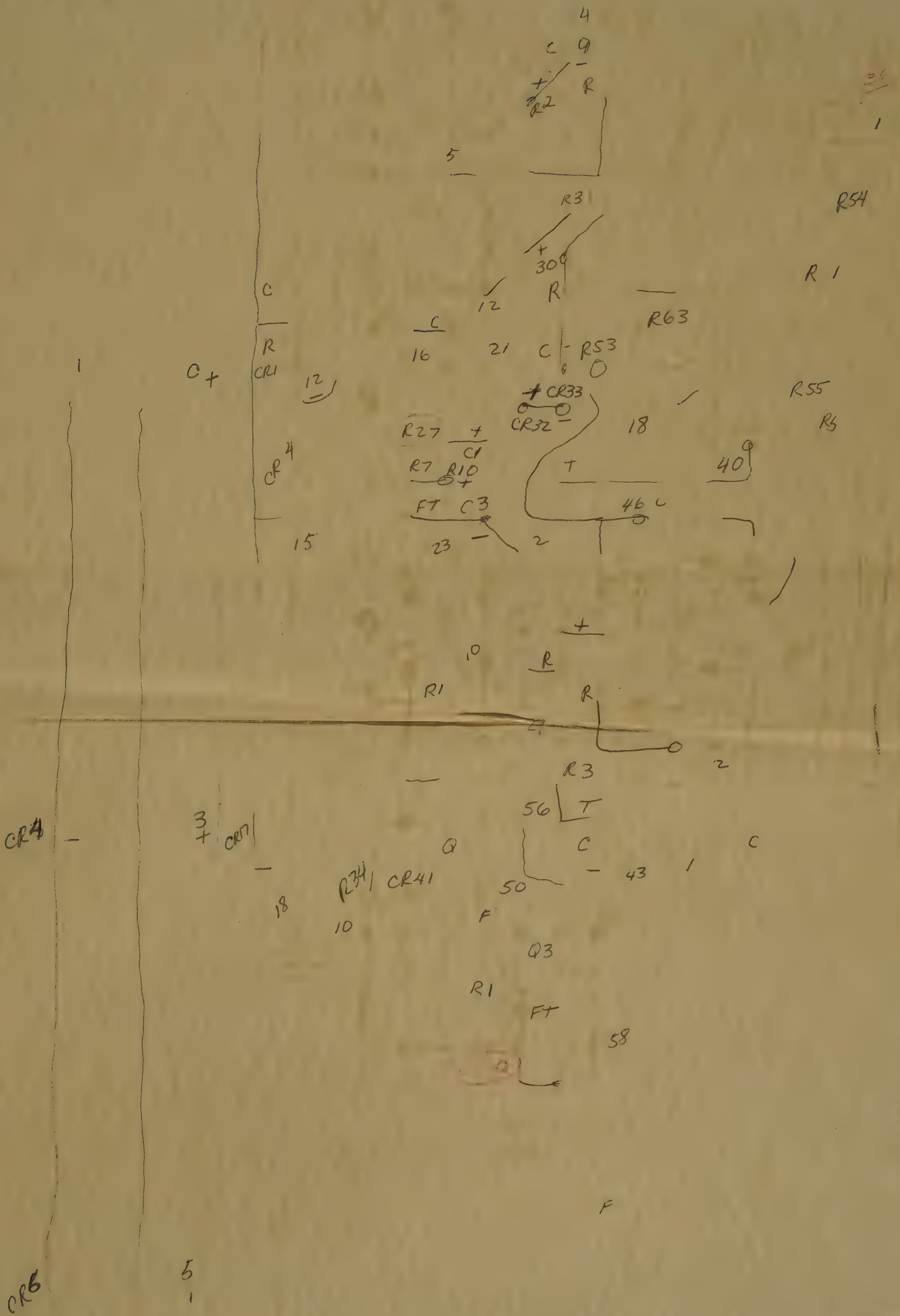
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5

46

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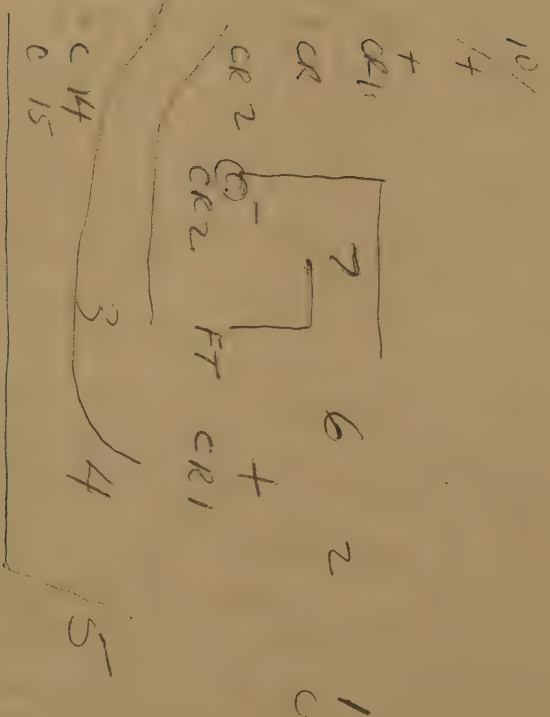
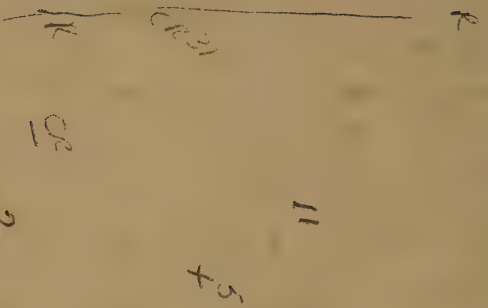
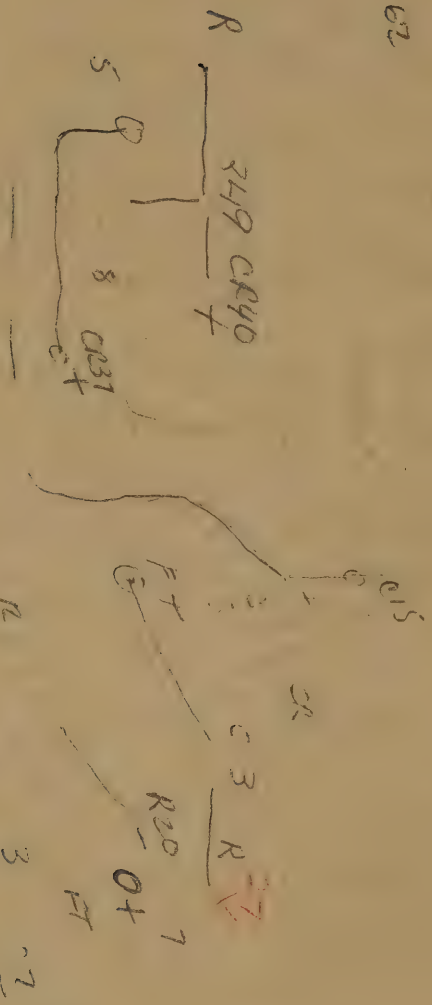
11-12-74



30
R54
44

1

62



400 Hz (OCT-3)

PRE-RUNCT.

162.5 - 161.5
162.4 - 161.4
162.5 - 161.5

160.1 - 159.4

131.4 - 130.4
131.2 - 129.9
131.3 - 130.0

128.00 - 122.5

103.5 - 104.5
103.6 - 104.7
103.8 - 104.9

106.4 - 107.2

104.55 - 106.11

5 MS P.W

RT = 5 sec

RT = 10 sec.

FILTER DELAY

600 Hz

60 Hz

0.72 MS

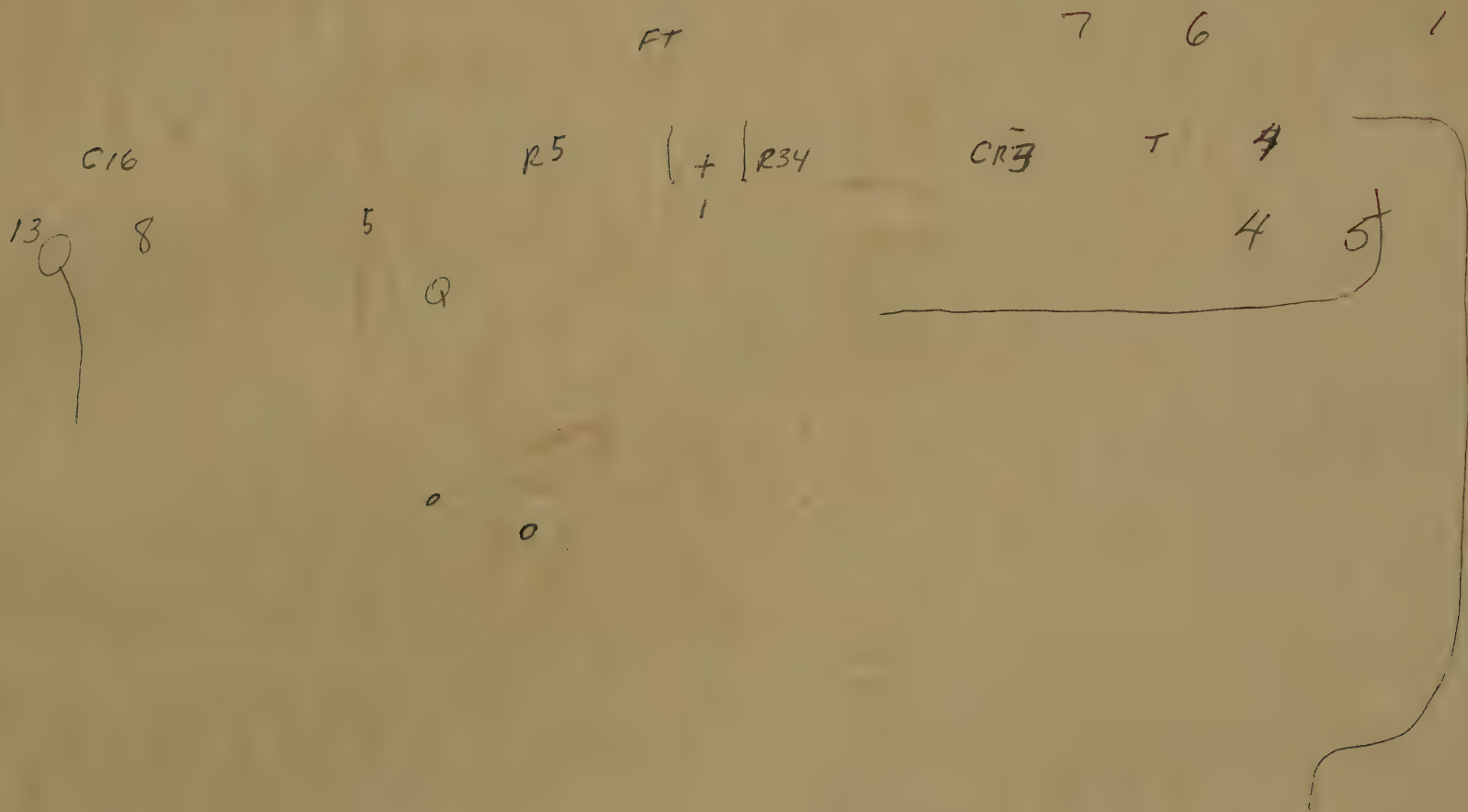
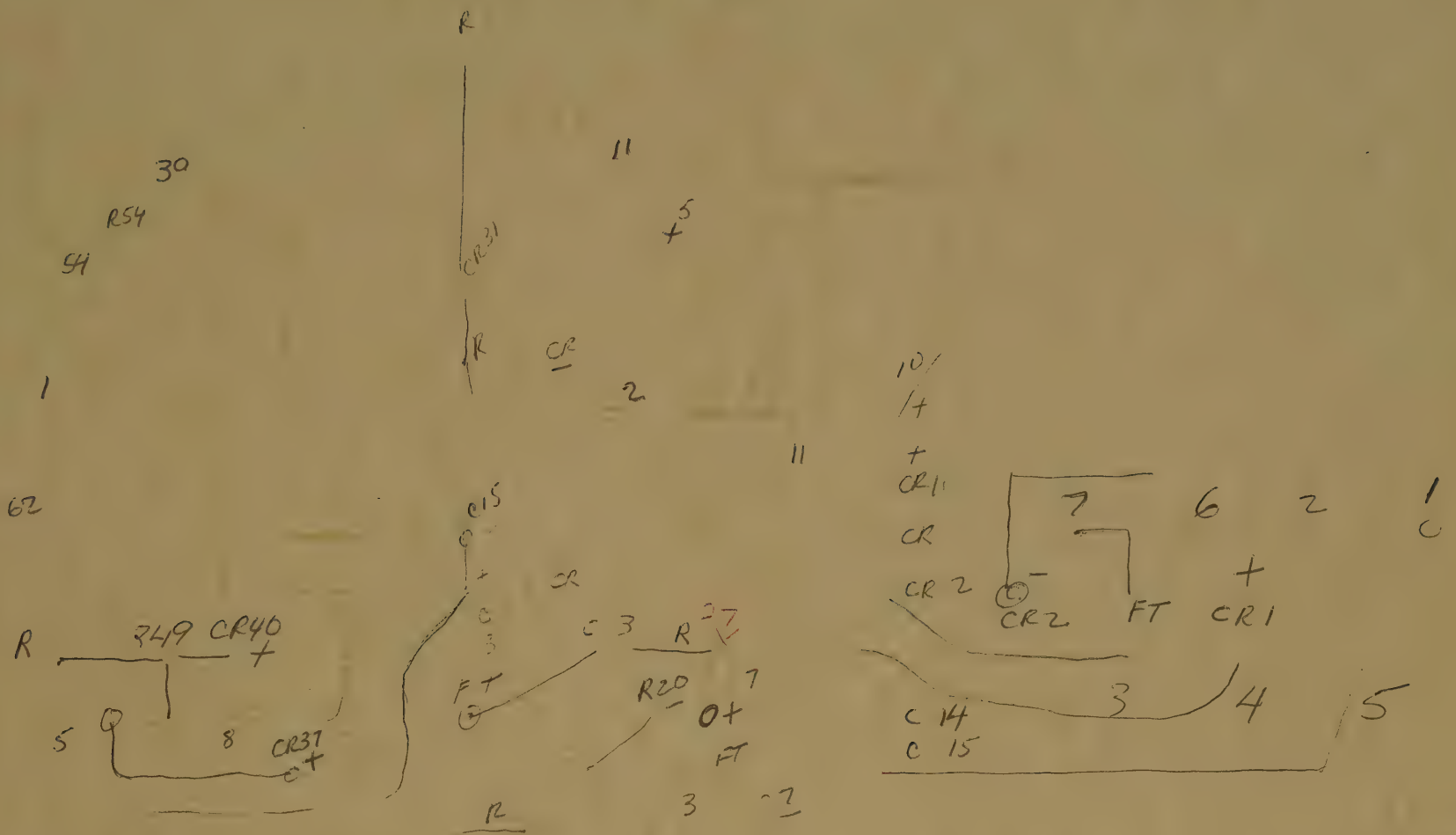
4.2 MS

40 Hz

160.0 - 161.0

162.8 - 162

163.0 -



Copy for old Pat. form 11-17-77

60048 007-3

PRE-TEST

162.5 - 161.5
162.4 - 161.4
162.5 - 161.5

160.1 - 159.6

131.6 - 130.7
131.2 - 129.8
131.3 - 130.0

129.00 - 127.5

103.5 - 104.5
103.6 - 104.7
103.8 - 104.9

106.1 - 107.2

104.55 - 106.11

SACZ P.W.

RT = 5 sec
RF = 10 sec.

FILTER DELAY

600 Hz
0.72 sec

600 Hz
0.72 sec

ONE

160.0 - 161.0
162.8 - 162
163.0

200 22

162.6 }
162.5 } 160.11
162.3 }

131.4 }
131.2 } 129.0
131.2 }

103.7 }
103.7 } 106.2
103.8 }

104.34 - 400 PULS
105.96

400
0.4 MS

60
4 MS

60 PULS

104.27

105.2

7.5 MS - P.W.

FT = 5 us.
RT = 10 us.

6042

130.7
130.6
130.6

103.4
103.5
103.5

40048

CR21, CR22 OPEN

SUMMING. IR = 10 MA

A

162.2 33.7 - 33.8 5.8300

131.0 27.3 27.7 4.77

B

162.0 33.7 33.7 5.82

131.4 27.5 27.5 4.79

C

161.1 33.8 33.8 5.84

131.3 27.7 27.8 4.79

A B C

156.25 A - 33.4 - 33.4 5.80

B - 33.1 - 33.2 5.85

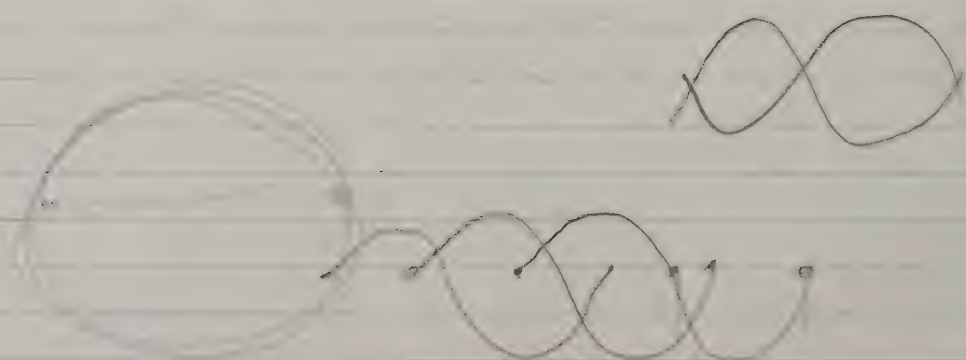
C - 33.3 - 33.3 5.86

2V

128.40 A - 27.3 - 27.4 4.78

B - 27.2 - 27.3 4.73

C - 27.3 - 27.3 4.77



600 Hz

A ϕ

TRIP	AC	FICT	SUM
160.2	35.5 35.4	5.99	5.58 ✓
130.4	29.2 29.3	4.86	4.47 ✓

B ϕ

160.2	35.8	5.99	5.50
130.5	29.3	4.87	4.48 ✓

C ϕ

160.2	35.8	5.99	5.58 ✓
130.4	29.3	4.87	4.47 ✓

A B C

155.8	A - 34.9	- 5.94	5.29 ✓
	B - 34.9	- 5.94	
	C - 34.9	- 5.95	

126.4	A - 28.4	- 4.81	4.44 ✓
	B - 28.3	- 4.82	
	C - 28.4	- 4.82	

~~60 Hz~~ ~~OPT. CREST OPEN.~~
~~TO MEET OUT TO ME~~

A # ~~NOTER OUT~~ ~~60 Hz~~

120 = 4.29
 131 = 4.67
 162 = 5.77

20mV 2.0mV

A # ~~60 Hz~~ 600 Hz

120 ✓ - 4.29
 131 - 4.67
 162 - 5.77

10mV RIPPLe

6042

TRIP

A ϕ
AC.

FICT -

SUM.

160.0.
129.2

35.7
28.8

5.93 -
4.83

5.57
4.43

B ϕ

160.8
129.6

35.8
29.0

5.95 -
4.84

5.56
4.45

C ϕ

159.9 -
129.6 -

35.7
29.0

5.86 -
4.74 -

5.54
4.44

A.B.C

155.5 -

A - 34.8 - 5.82
B - 34.7 - 5.83
C - 34.5 - 5.80

} 5.57

125.5

A - 28.1 - 4.76
B - 28.1 - 4.78
C - 38.2 - 4.77

} 4.45

26.943

27.223

27.058

27.720

27.100

27.100

27.100

27.200

$$10V = 1.7$$

$$10V = 2.1$$

27.100

27.100

4.779	5.037	5.201
3.594	3.850	3.900

14

6.164

101-6-082

6.165

0.1

6.166

3.900

2.02

6.167

0.1

2.600

1.7

1.700

Summing is at

1929

A

B

C

120 -

4.488

4.488

4.108

120 -

4.201

- 4.600

4.150

120 -

5.733

- 5.702

- 5.123

A

B

C

120 -

4.926

120 -

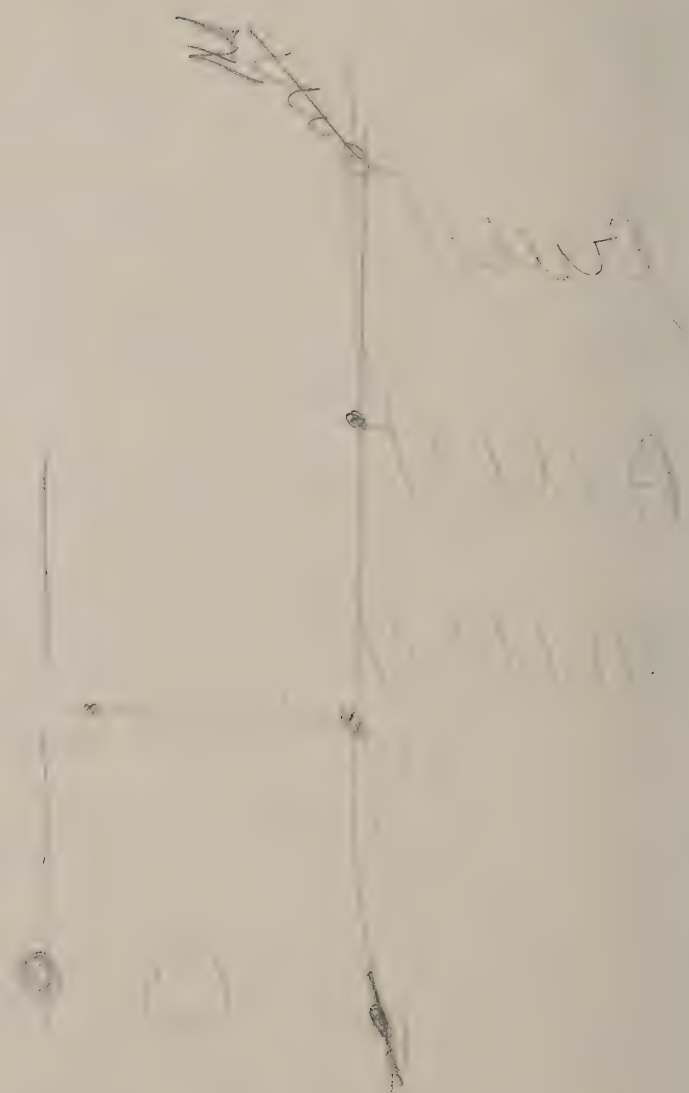
6.154

14.2
28.0

12.0

12.0

12.0



— 12th FEBRUARY —

	A	B	C
1200	50.09	49.80	50.07
1300	53.74	53.64	53.62
1600	64.74	62.12	66.03

	A	B	C
1300	54.25 [#]	54.02	54.12
1600	66.62	65.37	66.54

20 100

41 007

A - 20.167 - 20.152

21.020

B - 20.167

22.828

C - 20.167

22.000

A.B.C

~~150~~
26.114

41 007
26.157

E

109.

~~125~~
15.115
15.115

174

41 007
174

200 NS

154.8 - 5.0

154.8 - 5.83

155.0 - 5.83

152.97^{ABC} - 5.83

127.74 - 4.77

128.13 - 4.77

128.27 - 4.77

126.15^{ABC} - 4.78

60 ~

AB 154.4

127.9

ABC 152.8

121.4

124.5 = 54.5

1000000

RA 10.1
10.1
10.1
10.1

2.1
2.1
2.1
2.1

2.1
2.1
2.1
2.1

1000000
1000000
1000000
1000000

110.0 = 48

10.1
10.1
10.1
10.1

2.1
2.1
2.1
2.1

1000000
1000000
1000000
1000000

104.5 = 42.5

9.4
9.4
9.4
9.4

2.1
2.1
2.1
2.1

1000000
1000000
1000000
1000000

HUGHES AIRCRAFT COMPANY

FULLERTON, CALIFORNIA 92634

18 June 1974

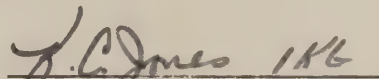
Parko
1540 South Lyon
Santa Ana, CA

Attn: Mr. Frank E. Parker

Gentlemen:

Your company is currently listed as a potential source of supply for the products specified on the enclosed documents. Please advise if any conflict exists between these documents and the product you would supply in the event of a purchase order.

This letter is for your information and should not be construed as a request for quote.



K. C. Jones
Components Engineering
Bldg. 604 M/S G244

Hughes
Document No.

Hughes
Part Ident No.

Supplier
Part No.

719710

719710-1

See drawing

464 A 719710-1
✓

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
-	SEE SHEET 11		

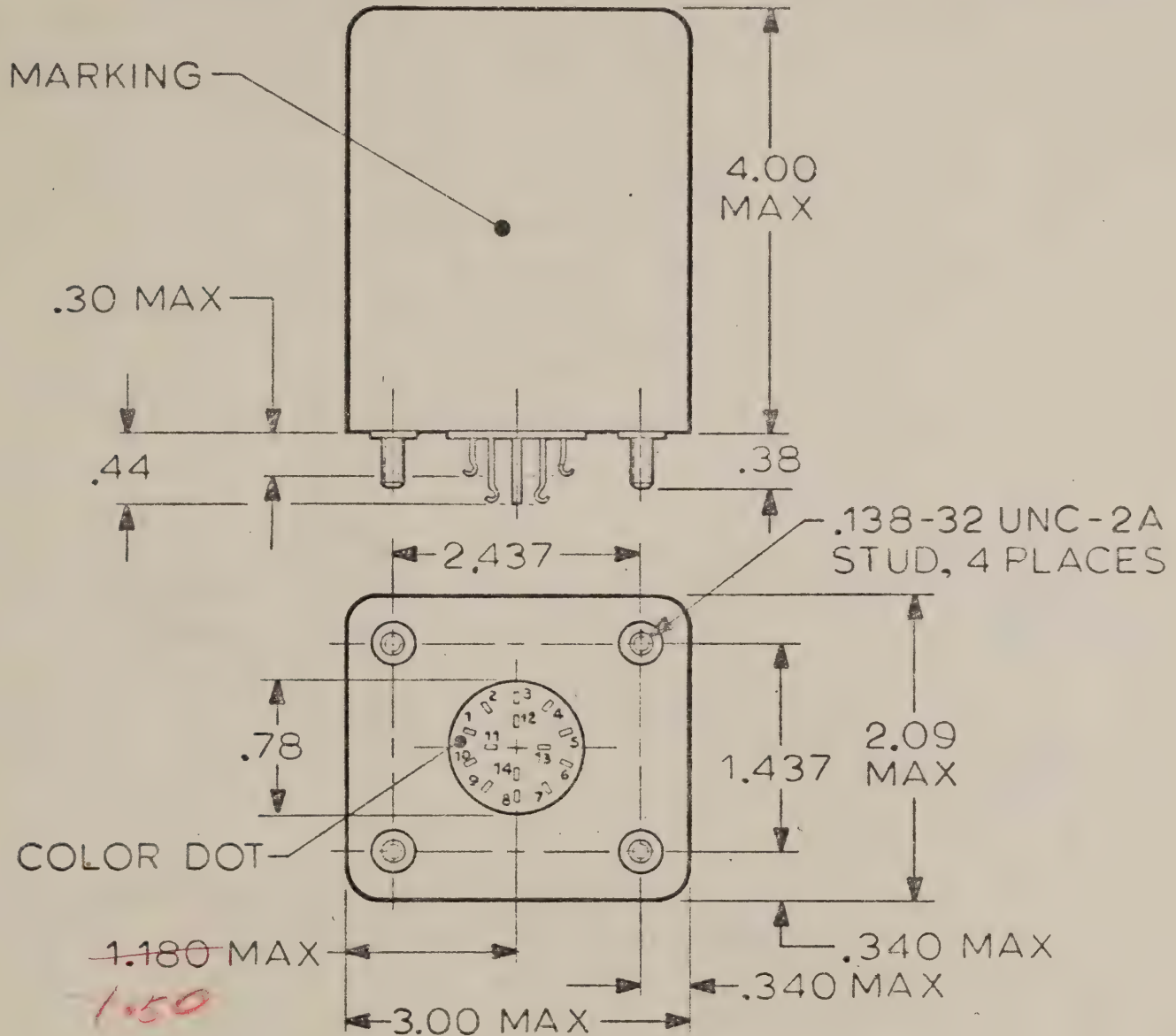
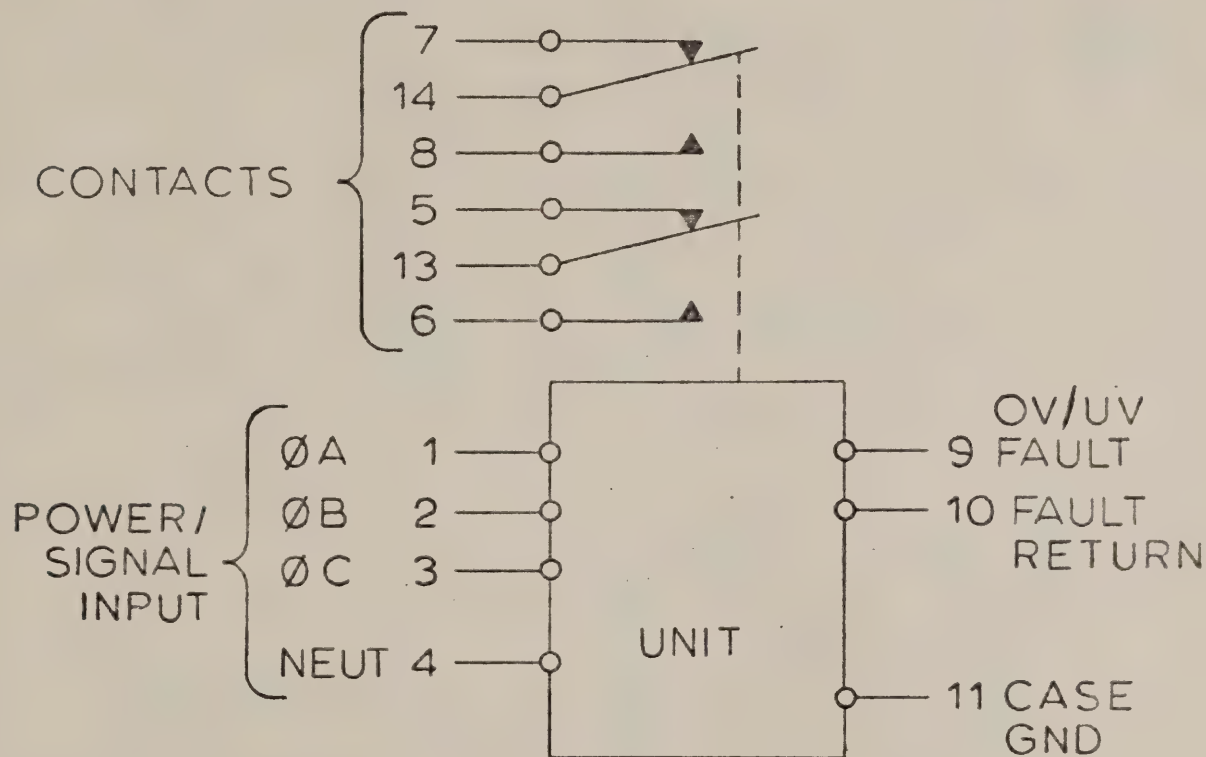


FIGURE 1: PHYSICAL DIMENSIONS
SPECIFICATION CONTROL DRAWING

PREPARED IN ACCORDANCE WITH MIL-STD-100A

INTERPRET DRAWING IN ACCORDANCE WITH MIL-D-1000, CATEGORY F, FORM 1

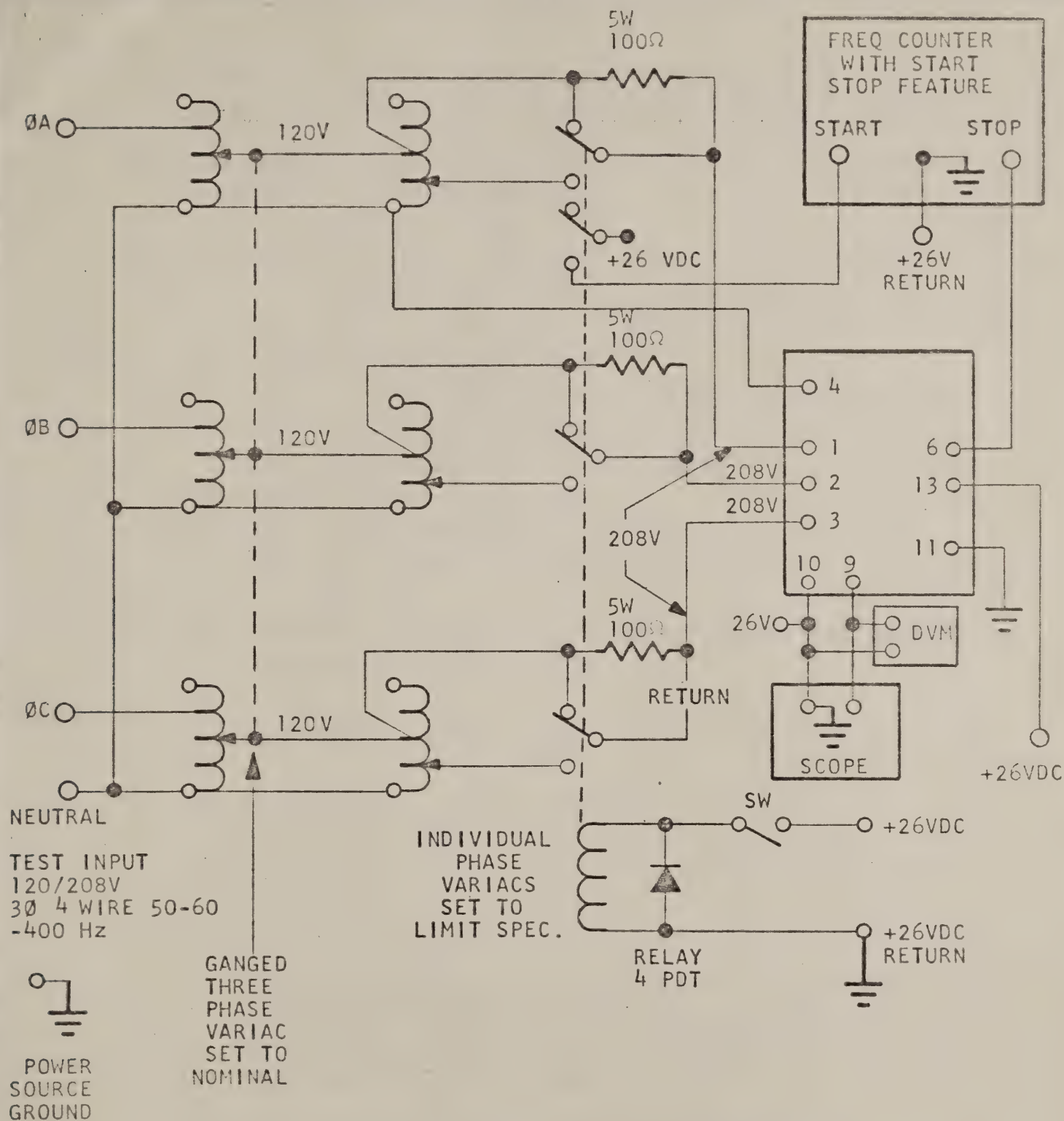
EXCEPT AS NOTED DIM. ARE IN INCHES AND PER ANS Y14.5 .XXX .XX ANGLES +.010 +.03 -		<div style="border: 1px solid black; padding: 2px; display: inline-block;">HUGHES</div> HUGHES AIRCRAFT COMPANY FULLERTON, CALIFORNIA	
MATERIAL		RELAY, SENSING (OVER-UNDER VOLTAGE)	
DR <i>H. Schuch</i> 74 APPD <i>H. Schuch</i> 10/11/74 CHK		SIZE	CODE IDENT NO.
		A	05869
		DRAWING NO.	719710
		SCALE	NONE
		WT	NOTE 13
		SHEET	1 OF 12



CIRCUIT DIAGRAM
UN-ENERGIZED POSITION

FIGURE 2

SIZE	CODE IDENT. NO.		REV
A	05869	719710	-
SCALE	NONE	SHEET	2



RECOMMENDED TEST SETUP FOR TIMING MEASUREMENT

FIGURE 3

SIZE	CODE IDENT NO	REV
A	05869	719710
SCALE NONE	SHEET 3	

NOTES:

1. PARTS SUPPLIED TO THIS DOCUMENT SHALL MEET THE GENERAL REQUIREMENTS OF SPECIFICATION MIL-R-28750 AND AS SPECIFIED HEREIN.
2. THE RELAY SHALL MEET THE ELECTRICAL REQUIREMENTS WHEN OPERATED UNDER THE FOLLOWING CONDITIONS:
 - (A) POWER/SIGNAL VOLTAGE:
 - (1) 120/208 VAC NOMINAL, 3 PHASE, WYE CONNECTED (4 WIRE INPUT), PHASE SEQUENCE ABC.
 - (2) RANGE OF OPERATION: 0 TO 175 VAC, PHASE TO NEUTRAL.
 - (B) POWER/SIGNAL FREQUENCY:
 - (1) 50, 60, 400 Hz NOMINAL (POWER SOURCE FREQUENCY).
 - (2) RANGE OF OPERATION: 47.5 TO 420 Hz.
 - (3) NO DAMAGE LIMIT: 45 TO 440 Hz.
 - (C) POWER/SIGNAL DISTORTION:
 - (1) TOTAL HARMONIC 5% MAXIMUM.
 - (2) INDIVIDUAL HARMONICS TO 7TH INCLUSIVE, EACH 3% MAXIMUM.
 - (D) POWER/SIGNAL MODULATION VOLTAGE INCLUDED IN NOMINAL OPERATION RANGE:

$$2\% \text{ MAXIMUM, } \% \text{MOD} = \frac{V_{\text{MAX}} - V_{\text{MIN}}}{V_{\text{MAX}} - V_{\text{MIN}}} \times 100$$

- (E) POWER/SIGNAL INPUT IMPEDANCE:

1,000 OHMS MINIMUM EACH PHASE TO PHASE.
- (F) OVER/UNDER VOLTAGE FAULT OUTPUT (ABBREVIATED, FAULT OUTPUT):

T²L COMPATIBLE WITH A CAPABILITY OF SUPPLYING AT LEAST 1.0 MILLIAMPERE AT 3.5 ± 1 VOLT FROM AN INTERNAL SOURCE IMPEDANCE OF 1,000 OHMS MAXIMUM. AT +0.5, -0, IT SHALL BE CAPABLE OF SINKING 10 MILLIAMPERES MINIMUM. THE MINIMUM PULSE WIDTH SHALL BE 3 MS.

SIZE A	CODE IDENT. NO. 05869	719710	REV -
SCALE NONE		SHEET	4

- (G) POWER/SIGNAL AND FAULT OUTPUT ISOLATION: 4
THE IMPEDANCE BETWEEN TERMINAL 10 AND 1, 2, 3, SHALL BE 50 K OHMS MINIMUM. THE RELAY CONTACTS SHALL BE ISOLATED FROM ALL VOLTAGE INPUT TERMINALS AND CASE. ALL TERMINALS SHALL ALSO BE ISOLATED FROM CASE BY 20 MEGOHMS MINIMUM, EXCEPT CASE GROUND.
- (H) OPERATING POWER:
OPERATING POWER SHALL BE TAKEN FROM THE POWER/SIGNAL INPUT LINES.
- (J) SIGNAL MONITORING:
ALL AC VOLTAGES ARE AVERAGE VALUES AS MEASURED BY AN RMS INDICATING, AVERAGE SENSING DIGITAL VOLTMETER OR EQUIVALENT.

3. VOLTAGE SENSING CHARACTERISTICS:

LIMIT 1: IF ANY PHASE OF THE NOMINAL INPUT VOLTAGE SHOULD INCREASE TO $129.5 + 3, -1V$, THE OTHER TWO PHASES HELD AT NOMINAL VOLTAGE OR IF ALL PHASES SIMULTANEOUSLY OF THE NOMINAL INPUT VOLTAGE SHOULD INCREASE TO $129.5 \pm 1V$, THE RELAY SHALL TRIP BETWEEN 1.8 AND 2.2 SECONDS; HOWEVER, IF THE VOLTAGE SHOULD DROP BELOW 128.5 VOLTS BEFORE 1.8 SECONDS, THE RELAY SHALL NOT TRIP. AFTER TRIP, IF THE VOLTAGE SHOULD DECREASE, THE RESET DIFFERENTIAL VOLTAGE SHALL NOT EXCEED 2.0 VOLTS. THE RESET TIME SHALL NOT EXCEED 0.2 SECOND.

LIMIT 2: IF ANY PHASE OF THE INPUT VOLTAGE SHOULD INCREASE ABOVE $161 \pm 2V$, THE RELAY SHALL TRIP WITHIN ~~30~~ 150 MS. AFTER TRIP IF THE VOLTAGE SHOULD DECREASE BELOW LIMIT 1, THE RELAY SHALL PULL IN.

LIMIT 3: IF ANY PHASE OF THE NOMINAL INPUT VOLTAGE SHOULD DECREASE TO 104.5 ± 2 VOLTS, THE OTHER TWO PHASES HELD AT NOMINAL VOLTAGE OR IF ALL PHASES SIMULTANEOUSLY OF THE NOMINAL INPUT VOLTAGE SHOULD DECREASE TO 104.5 ± 2 VOLTS, THE RELAY SHALL TRIP BETWEEN 4.5 AND 5.5 SECONDS. HOWEVER, IF THE VOLTAGE SHOULD INCREASE ABOVE 102.5 VOLTS BEFORE 4.5 SECONDS,

SIZE A	CODE IDENT. NO. 05869	719710	REV -
SCALE NONE		SHEET 5	

3. (CONTINUED)

LIMIT 3 (CONTINUED):

THE RELAY SHALL NOT TRIP. AFTER TRIP, IF THE VOLTAGE SHOULD INCREASE, THE RESET DIFFERENTIAL VOLTAGE SHALL NOT EXCEED 2.0 VOLTS. THE RESET TIME SHALL NOT EXCEED 0.2 SECONDS.

IF ALL PHASES SIMULTANEOUSLY SHOULD DECREASE TO 104.5 ± 2 V, THE FAULT OUTPUT SHALL BE $-0, +.5$ VOLTS. IF THE VOLTAGE SHOULD INCREASE BACK TO ~~105.5~~ ^{105.6} VOLTS OR HIGHER, THE FAULT OUTPUT SHALL BE 3.5 ± 1 VOLT. THE RESET DIFFERENTIAL VOLTAGE SHALL NOT EXCEED 2.0 VOLTS. THE RELAY IN EITHER CASE SHALL NOT TRIP. ~~THE~~ RISE AND FALL TIME OF THE FAULT OUTPUT SHALL NOT EXCEED 0.1 MILLISECONDS, AND THE PULSE WIDTH SHALL NOT BE LESS THAN 3 MILLISECONDS.

IF ALL PHASES SIMULTANEOUSLY SHOULD DECREASE FROM NOMINAL TO 75 ± 5 VOLTS, THE DELAY TIME BETWEEN THE PASSING OF ANY ONE PHASE TO NEUTRAL INPUT THROUGH THE 104.5 ± 2 VOLTS REGION AND THE FAULT OUTPUT SHALL NOT BE GREATER THAN 6 MILLISECONDS AT 50 OR 60 Hz INPUT AND 1 MILLISECOND AT 400 Hz INPUT. IF ALL PHASES SIMULTANEOUSLY SHOULD INCREASE FROM 75 ± 5 VOLTS TO NOMINAL, THE DELAY TIME SHALL NOT BE GREATER THAN 2 MILLISECONDS.

LIMIT 4: THE SENSOR SHALL START TO OPERATE AND THE RELAY SHALL BECOME ENERGIZED WHEN THE THREE PHASE INPUT, FROM ZERO VOLTS, REACHES 90 VOLTS OR BEFORE. THE SENSOR SHALL CEASE TO OPERATE AT 45 VOLTS OR BELOW WHEN THE THREE PHASE NOMINAL INPUT IS REMOVED.

FAULT OUTPUT: IN ADDITION, A FAULT OUTPUT OF $-0, +.5$ VOLTS SHALL ALSO OCCUR WHENEVER THE LIMITS OF 1 AND 2 ARE EXCEEDED, TIMewise, TO OCCUR PRIOR TO THE OPENING OF THE CLOSED CONTACTS.


NO TRIP LIMIT: INPUT SIGNAL VARIATIONS OF A PULSE DURATION OF 100 μ SEC OR LESS, WHETHER IN OR OUT OF LIMITS 1, 2 OR 3, SHALL NOT CAUSE NUISANCE TRIP OR RESET OF RELAY, OR A FAULT OUTPUT.

SIZE A	CODE IDENT. NO. 05869	719710	REV -
SCALE NONE		SHEET 5	

3. (CONTINUED)

MISSING VOLTAGE: IF ANY ONE PHASE VOLTAGE IS NOT APPLIED OR REMOVED AFTER IT HAS BEEN APPLIED, THE OTHER TWO PHASES BEING CONTINUOUSLY APPLIED, CONTACTS 6 AND 13 SHALL REMAIN OR BECOME OPEN RESPECTIVELY. TRIP TIME SHALL BE NO GREATER THAN 0.2 SECONDS IF PHASE VOLTAGE IS APPLIED AND THEN REMOVED.

MONITORING TERMINALS: CONTACTS 5, 6 AND 13 SHALL BE MONITORED FOR THESE TESTS. CONTACTS 7, 8 AND 14 SHALL ONLY BE MONITORED WITH CONTACTS 5, 6 AND 13 DURING MISSING VOLTAGE TEST. TRIP TIME SHALL BE MONITORED AS THE OPENING OF CONTACTS 6 AND 13. SEE FIGURE 3.

 NOMINAL OPERATION: CONTACTS 8 AND 14 AND 6 AND 13 SHALL BE CLOSED (HAVE CONTINUITY) WHEN 120 VOLTS $\pm 10\%$ AND 50, 60 OR 400 Hz $\pm 5\%$ ARE APPLIED TO THEIR APPROPRIATE TERMINALS.

4. TEST CONDITIONS: WITH A 3 \emptyset POWER SOURCE THAT WILL PROVIDE A VARIABLE VOLTAGE ON EACH PHASE TO NEUTRAL, APPLY 120 VOLTS $\pm 1\%$, 60 ± 3 Hz BETWEEN TERMINALS 1, 2, 3 AND 4 WITH TERMINAL 11 CONNECTED TO POWER SOURCE GROUND, TEST AS FOLLOWS:

LIMIT 1: INCREASE PHASE A VOLTAGE FROM NOMINAL TO 129.5 +3, -1 VOLTS AND RECORD THE TRIP TIME AND VOLTAGE. AFTER THE RELAY TRIPS, DECREASE PHASE A VOLTAGE TOWARD NOMINAL AND RECORD DIFFERENTIAL VOLTAGE AND RESET TIME. RECORD THE FAULT OUTPUT BEFORE AND AFTER THE RELAY TRIPS.

LIMIT 2: TRIP VOLTAGE - VARY PHASE A TO 161 ± 2 V AND RECORD TRIP VOLTAGE, REGARDLESS OF TRIP TIME. AFTER RELAY TRIPS, DECREASE PHASE A VOLTAGE TO NOMINAL. RECORD THE FAULT OUTPUT BEFORE AND AFTER THE REALY TRIPS.

TRIP TIME - VARY PHASE A RAPIDLY THROUGH THE 161 ± 2 V REGION TO 170 ± 2 V AND RECORD TRIP TIME. AFTER RELAY TRIPS, DECREASE PHASE A VOLTAGE BELOW 128.5V.

SIZE A	CODE IDENT. NO. 05869	719710	REV -
SCALE NONE		SHEET 7	

4. (CONTINUED)

LIMIT 3: TRIP VOLTAGE - DECREASE ALL THREE PHASES SLOWLY FROM NOMINAL JUST PASS 104.5 ± 2 VOLTS AND RECORD THE TRIP VOLTAGE WHERE THE FAULT OUTPUT CHANGES FROM 3.5 ± 1 VOLT TO $-0, +0.5$ VOLTS. ALSO RECORD THE FAULT OUTPUT PULSE WIDTH AND FALL TIME. STARTING FROM 75 ± 5 VOLTS, INCREASE ALL THREE PHASES SLOWLY JUST PAST 104.5 ± 2 VOLTS AND RECORD THE TRIP VOLTAGE WHERE THE FAULT OUTPUT CHANGES FROM $-0, +0.5$ VOLTS TO 3.5 ± 1 VOLT. ALSO RECORD THE FAULT OUTPUT PULSE WIDTH AND RISE TIME.

TRIP TIME - DECREASE ALL PHASES SIMULTANEOUSLY FROM NOMINAL, VERY RAPIDLY THROUGH THE 104.5 ± 2 VOLT REGION TO 75 ± 5 VOLTS AND RECORD THE DELAY TIME BETWEEN THE PASSING OF ANY ONE PHASE TO NEUTRAL INPUT THROUGH THE 104.5 ± 2 VOLT REGION AND THE FAULT OUTPUT. INCREASE ALL PHASES SIMULTANEOUSLY FROM 75 ± 5 VOLTS VERY RAPIDLY THROUGH THE 104.5 ± 2 VOLT REGION TO NOMINAL AND RECORD THE DELAY TIME.

LIMIT 4: INCREASE THE THREE PHASE VOLTAGE FROM ZERO VOLTS TO NOMINAL AND RECORD THE TRIP VOLTAGE WHERE THE RELAY BECOMES ENERGIZED. DECREASE THE THREE PHASE VOLTAGE FROM NOMINAL TO ZERO VOLTS AND RECORD THE TRIP VOLTAGE WHERE THE RELAY DE-ENERGIZES.

REPEAT LIMIT 1 EXCEPT VARY PHASE B. REPEAT AGAIN EXCEPT VARY PHASE C. REPEAT LIMIT 1 FOR ALL THREE PHASES SIMULTANEOUSLY EXCEPT VARY TO 129.5 ± 1 VOLT.

→ REPEAT LIMIT 3 EXCEPT APPLY $400 \text{ Hz} \pm 20 \text{ Hz}$ TO INPUT.

5. DURING THE CHARACTERISTIC VOLTAGE SENSING TESTS, THE RELAY SHALL TRIP AND RESET IN THE SPECIFIED TIME AND AT THE SPECIFIED VOLTAGE. THE FAULT OUTPUT SHALL PERFORM AS SPECIFIED.

SIZE A	CODE IDENT. NO 05869	719710	REV -
SCALE NONE		SHEET 8	

6. DIELECTRIC WITHSTANDING VOLTAGE: PER MIL-R-28750 EXCEPT THE VOLTAGE AMPLITUDE SHALL BE 1000 V RMS, 60 Hz BETWEEN PINS AND CASE.

7. INSULATION RESISTANCE: PER MIL-R-28750.

8. ENVIRONMENTAL REQUIREMENTS:

OPERATING TEMPERATURE: 0°C TO +71°C

STORAGE TEMPERATURE: -20°C TO +85°C

VIBRATION: PER MIL-R-28750 EXCEPT THE AMPLITUDE AND FREQUENCY SHALL BE 10 G'S, 10 TO 500 Hz.

SHOCK: PER MIL-R-28750, 100 G'S, 6 MS DURATION.

THERMAL SHOCK: PER MIL-R-28750.

MOISTURE RESISTANCE: PER MIL-R-28750.

SALT SPRAY: PER MIL-R-28750.

ENDURANCE PER MIL-R-28750 EXCEPT THAT ONLY 50,000 OPERATIONS SHALL BE PERFORMED. A CYCLE IN THIS LIFE TEST IS DEFINED AS FOLLOWS:

APPLY $120 \pm 1\%$, 60 ± 3 Hz BETWEEN TERMINALS 1, 2, 3 AND 4 INCREASE THE VOLTAGE TO 135 VOLTS FOR 10 SECONDS. DECREASE TO 120 VOLTS FOR 20 SECONDS THEN DECREASE THE VOLTAGE TO 100 VOLTS FOR 10 SECONDS, INCREASE THE VOLTAGE TO 120 VOLTS FOR 20 SECONDS. THE CONTACT LOAD SHALL BE 5 AMPERES RESISTIVE AT 28 VDC AND THE TEMPERATURE SHALL BE +71°C. AFTER LIFE, PERFORM INSULATION RESISTANCE, DIELECTRIC WITHSTANDING VOLTAGE, CONTACT RESISTANCE AND THE OPERATING CHARACTERISTIC TESTS. AFTER LIFE THE CONTACT VOLTAGE DROP SHALL NOT EXCEED 200 mV.

9. RELAY USED INTERNALLY SHALL MEET ALL REQUIREMENTS OF THIS SPECIFICATION.

10. MECHANICAL REQUIREMENTS:

WEIGHT _____ 20 OUNCES MAXIMUM 32.57

TERMINALS _____ SOLDER HOOK, SUITABLY THREADED TO FACILITATE SOLDERING

MOUNTING ATTITUDE _____ THE RELAY SHALL MEET ALL REQUIREMENTS WHEN MOUNTED IN ANY POSITION.

SIZE A	CODE IDENT. NO 05869	719710	REV —
SCALE NONE		SHEET 9	

11. MARKING. EACH RELAY SHALL BE PERMANENTLY AND LEGIBLY MARKED WITH THE FOLLOWING INFORMATION IN ACCORDANCE WITH MIL-STD-130:

- (A) THE HUGHES-FULLERTON PART IDENT NUMBER
- (B) MANUFACTURER'S NAME OR SYMBOL AND PART NUMBER
- (C) EIA DATE CODE
- (D) TERMINAL IDENTIFICATION
- (E) CIRCUIT DIAGRAM

TABLE I - RELAY REQUIREMENTS

HUGHES PART IDENT NUMBER	CONTACT ARRANGEMENT	CONTACT RATING AT 28 VDC OR 115 VAC		CONTACT BOUNCE MAXIMUM
		RESISTIVE	INDUCTIVE	
719710-1	DPDT	5 AMPS	2 AMPS	2 MILLISECONDS

SIZE A	CODE IDENT. NO. 05869	719710	REV -
SCALE NONE		SHEET 10	

RELEASE AND REVISION RECORD				
REV	DESCRIPTION	DATE	APPROVED	
-	RELEASED	6-10-74	R. W. Smith	

SIZE		CODE IDENT. NO.		719710		REV
A		05869				-
SCALE		NONE		SHEET		11

DESCRIPTION

APPROVED

RELEASED

6-10-79

R. L. Smith

CODE IDENT. NO.

05869

719710

IN 1925

Figure 1

SCALE NONE

SHEET

where \mathbf{y}

HUGHES IDENT NUMBER	SUPPLIER PART NUMBERS		
	PARKO ELECTRONICS		
719710-1	101280		

SUGGESTED SOURCE(S) OF SUPPLY:

PARKO ELECTRONICS INC., SANTA ANA, CALIF. FSCM 13979

SIZE A	CODE IDENT. NO 05869	719710	REV -
SCALE NONE		SHEET	12

101280

3/14/79

QUESTIONS ON WORKER SPEC
719710

PAGE 1: FIG 1.

a) UNIT A .133-32 UNC-2A
STUD?

b) CENTER OF GRAVITY SHOULD
BE 1.50 MM OR LESS
UNITED OFF CENTER.

PAGE 5: PARA. 6 SECOND LINE: ADD
TERMINAL 4

LIMIT 2: TRIP TIME 30 MS:

I WONDER IF WE CAN MEET THIS
VALUE AT THE 60 HZ. WITH
THE 400 HZ UNIT WE COULD MAKE
IT UNDER 30 MS.

LIMIT 3: IF THIS UNIT IS TO
OPERATE LIKE THE 1000 HZ (PHASE
3 PHASE) THE FIRST SECTION OF
THIS LIMIT SHOULD BE DELETED
AND START AT PAGE 6 WITH THE
PARA. " IF ALL PHASES - - - - - "

THE FIRST PART ASK FOR THE
RELAY TO TRIP AND THE SECOND
PART ASK FOR THE RELAY NOT
TO TRIP.

PAGE 7: TEST CONDITIONS THE TESTS
CALLED OUT FOR LIMITS 1, 2
3 AND 4 ARE ALL AT 50 HZ
EXCEPT THAT AT THE END
OF LIMIT FOUR IT ASK TO
REPEAT LIMIT 3 AT 400 HZ.
DOES THIS MEAN THAT WE

HAVE TO CHECK THE UNITS AT 400K3
ON LIMIT 3 ONLY?

THE 101064 UNIT HAD PHASE
SEQUENCE DETECTOR. IT WAS NOT CALLED
OUT IN THEIR SPEC BUT IT IS IN
OUR DRAWING.

NO
HOW DO WE MAKE THIS ONE?
IT IS NOT CALLED OUT IN THEIR
SPEC.

101280

9/13/72

KRI PRELIMINARY PART 2.25

V_1, V_2, V_3 - 4558
 V_4 - 741
 $Q1, Q2, Q3, Q5$ - 2N3224
 $Q4$ - 2N3224 (VPP 84V)
 $CR1$ TO $CR22$ - 1N545
 $CR23$ - 1N965C
 $CR24$ - 1N744
 $CR25$ TO $CR38$ - 1N4148
 $CR39$ - 1N744H

$C1$ - 78V/50V MPP
 $C2$ - .01 - CH12
 $C3$ - 15V/30V - 69F
 $C4, C5, C6$ - 2.2/20 - 203
 $C7$ - .1/20 - 203
 $C8$ - .47/20 - 203
 $C9$ - .1/20 - 203
 $C10$ - .47/20 - 203
 $C11, C12, C13$ - 2.2/20 - 203
 $C14, C15$ - .22/20 - 203
 $C16$ - 1.5/20 - 203
 $C17, C18$ - 15V/30V - 69F
 $R1$ - 3.9K - R007
 $R3$ - 2.2K - R007
 $R4, R5, R6$ - 23.7K - R060
 $R7$ - 5.1K - R060
 $R8$ - 7.5K - R060
 $R9, R10, R11$ - 31.6K - R060
 $R12$ - 4.22K - R060
 $R13$ - 6.19K - R060
 $R19, R20, R21$ - 5K - 3229K POT
 $R22$ - 4.22K - R060
 $R23$ - 6.19K - R060
 $R24, R25, R26$ - 21.5K - R060
 $R27$ - 100K - R007
 $R28, R29$ - 470K - R007

R30	-	409H	-	R450	-
R31	-	500H	-	5129H	Ref
R32	-	12.1H	-	R450	-
R33	-	470H	-	R007	-
R34	-	470H	-	R007	-
R35	-	1.1H	-	12450	-
R36	-	500H	-	3329H	Ref
R37	-	5.11H	-	R150 R450	-
R38	-	1.47H	-	R450	-
R39	-	500H	-	3329H	Ref
R40	-	4.22H	-	R450	-
R41, R42, R43	-	470H	-	R007	-
R44	-	6.11H	-	R450	-
R45	-	6.8H	-	R007	-
R46	-	110H	-	R450	-
R47	-	147H	-	R450	-
R48	-	178H	-	R450	-
R49, R50, R51	-	13H	-	R007	-
R52	-	Timing	-	2 R450	(2 sec)
R53	-	Timing	-	2 R450	(5 sec)
R54, R55	-	1.5H	-	R007	-
R56	-	10H	-	R007	-
R57	-	1H	-	R007	-
R58	-	400H	-	2W - 240E	00 min
R59, R60, R61	-	18H	-	R007	-

T1, T2, T3 - ALUOR 5785

L1 ALUOR 5759

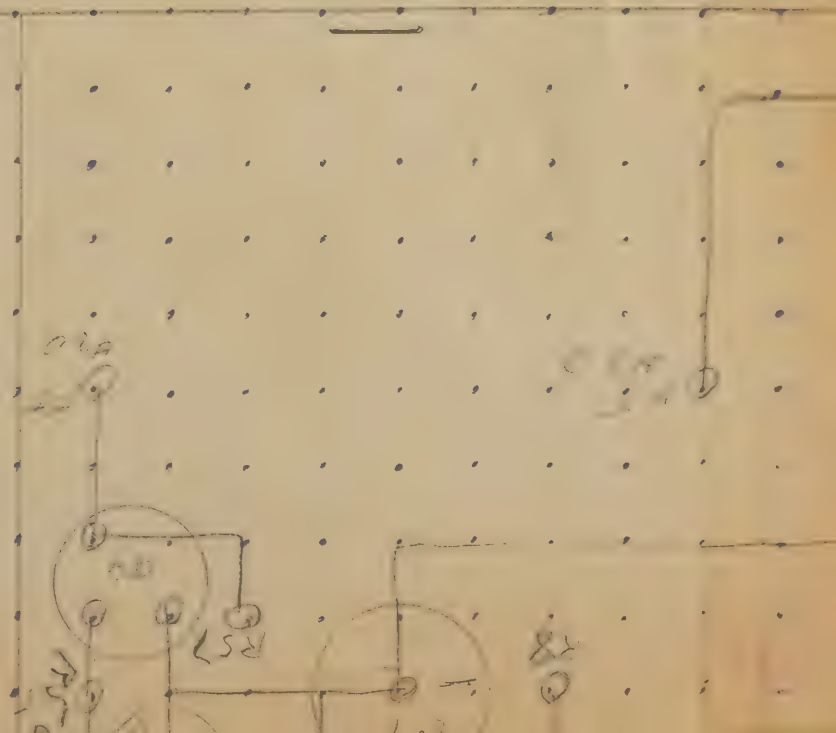
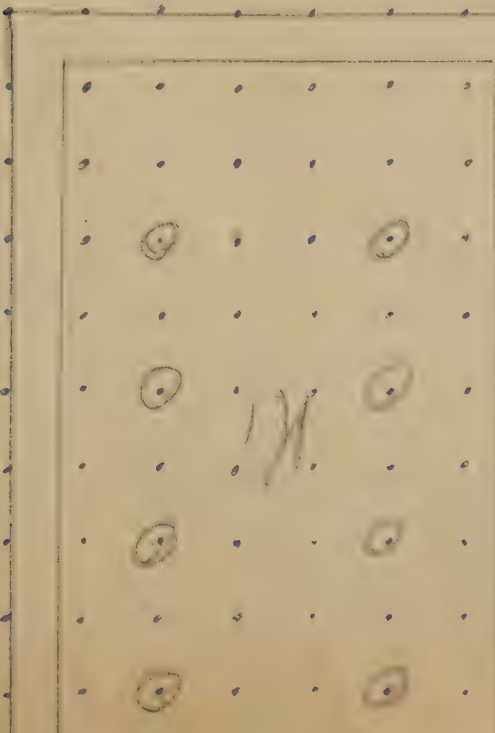
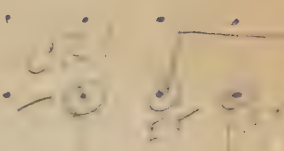
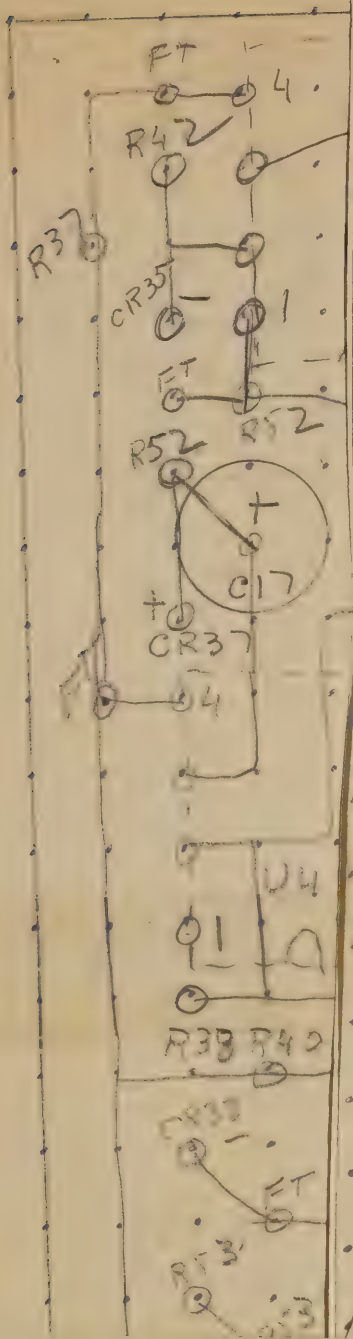
K1 - BR71-400X1-200
A

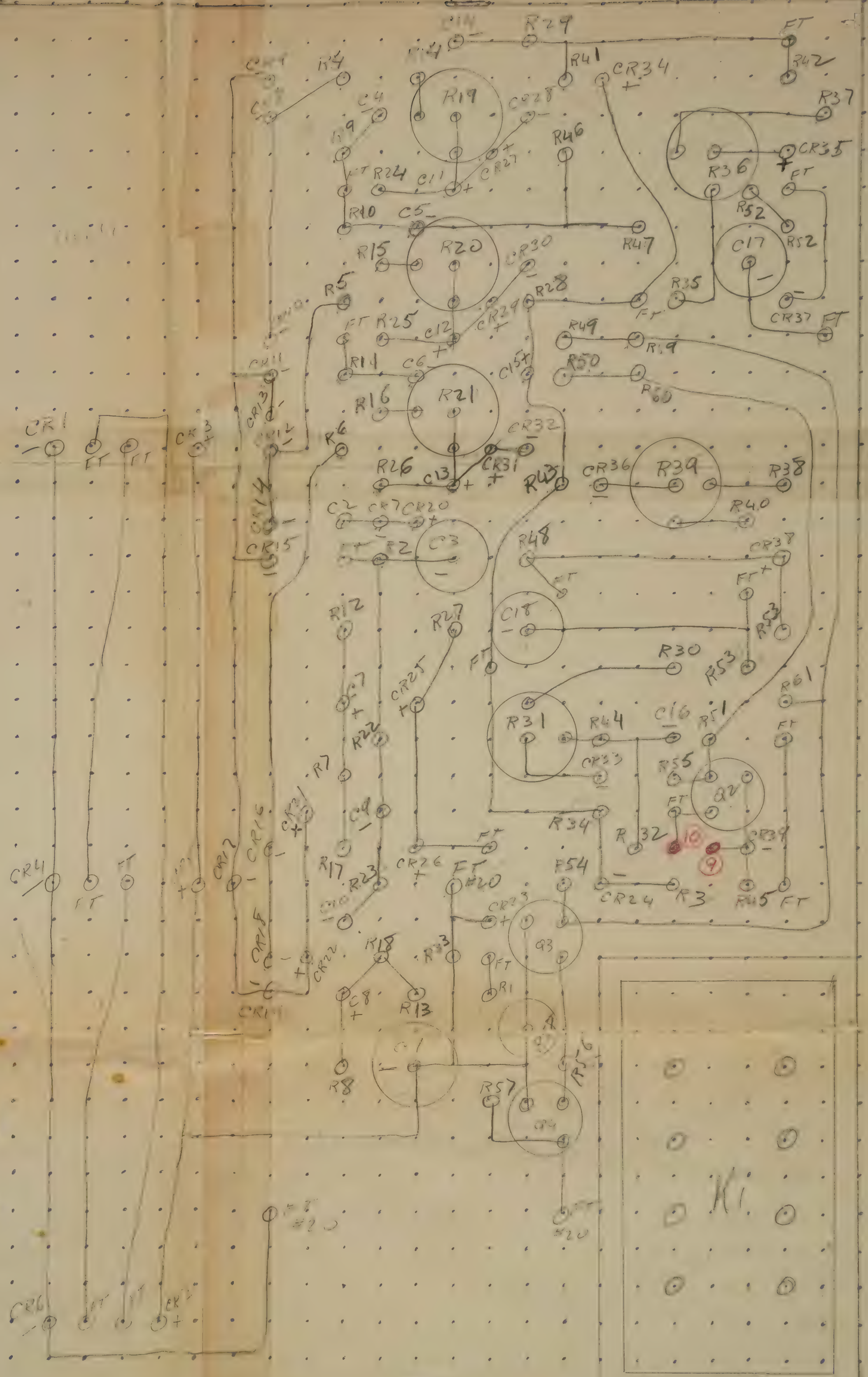
R14, R15, R16 - 26.1H R450

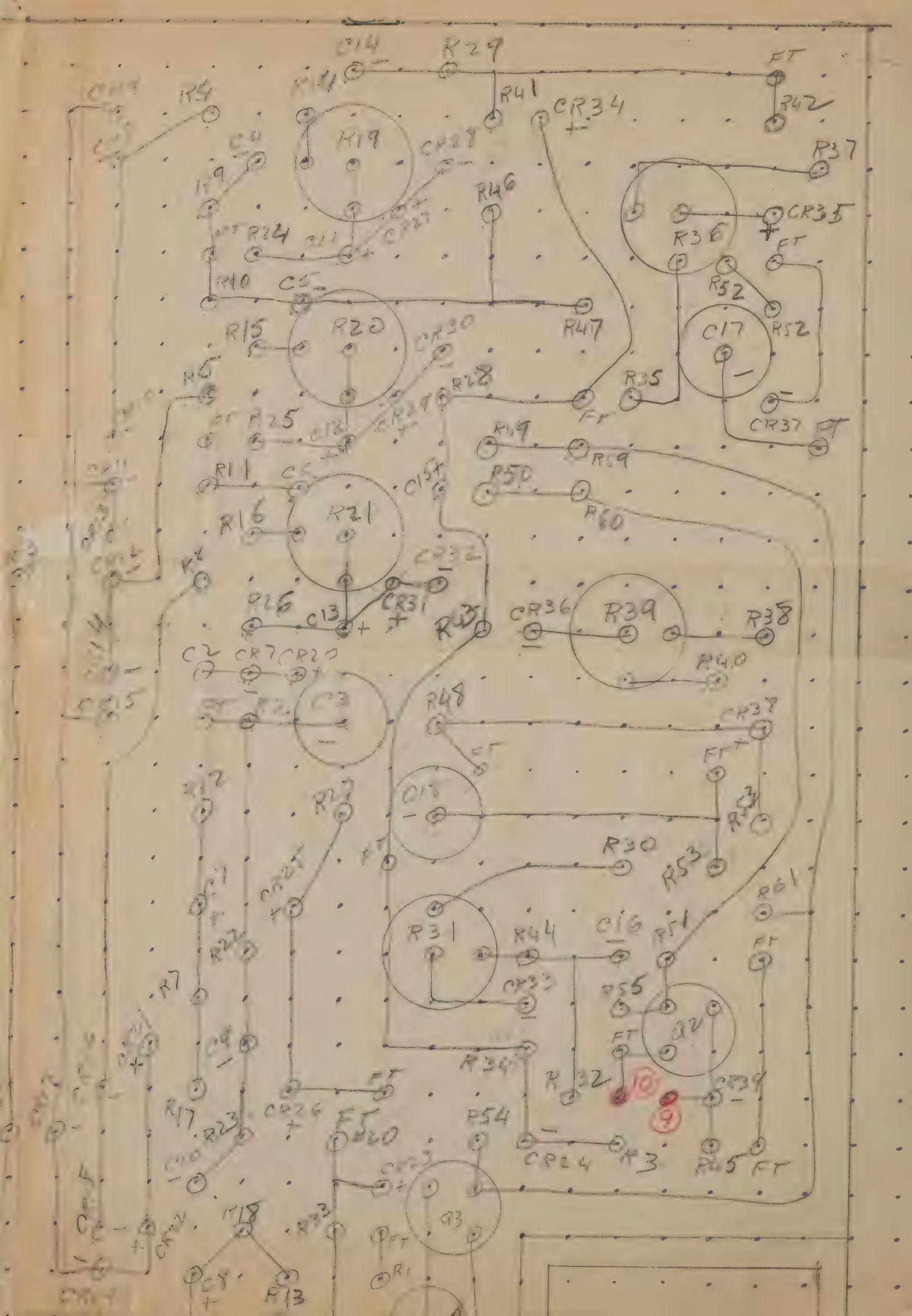
R17 - 4.64 R450

R18 - 6.81 R450

Can - 4000 3.4-5T







74-810

REVISIONS			
LT#	DESCRIPTION	DATE	APPROVED
-	SEE SHEET 11		

MARKING

.30 MAX

4.00
MAX

RECEIVED

MAY 30 1974

.44

.38

2.437

.138-32 UNC-2A
STUD, 4 PLACES

.78

1.437

2.09
MAX

COLOR DOT

1.180 MAX

.340 MAX

.340 MAX

3.00 MAX

FIGURE 1 PHYSICAL DIMENSIONS
SPECIFICATION CONTROL DRAWING

PREPARED IN ACCORDANCE WITH MIL-STD-883C

INTERPRET DRAWING IN ACCORDANCE WITH MIL-D-1000, CATEGORY F, FORM 1

DO NOT USE FOR PROCUREMENT

ALL DIMENSIONS
DIM. ARE IN INCHES
AND PER ANG. Y14.5
.XXX .XX ANGLES
+.010 +.03 --

MATERIAL

DR *A. Schmitt 74*

CHK

APPD

HUGHES

HUGHES ELECTRONIC COMPANY
FULLERTON, CALIFORNIA

RELAY, SENSING (OVER-UNDER VOLTAGE)

SIZE COORDINATE NO. DRAWING I.D.

A

05869

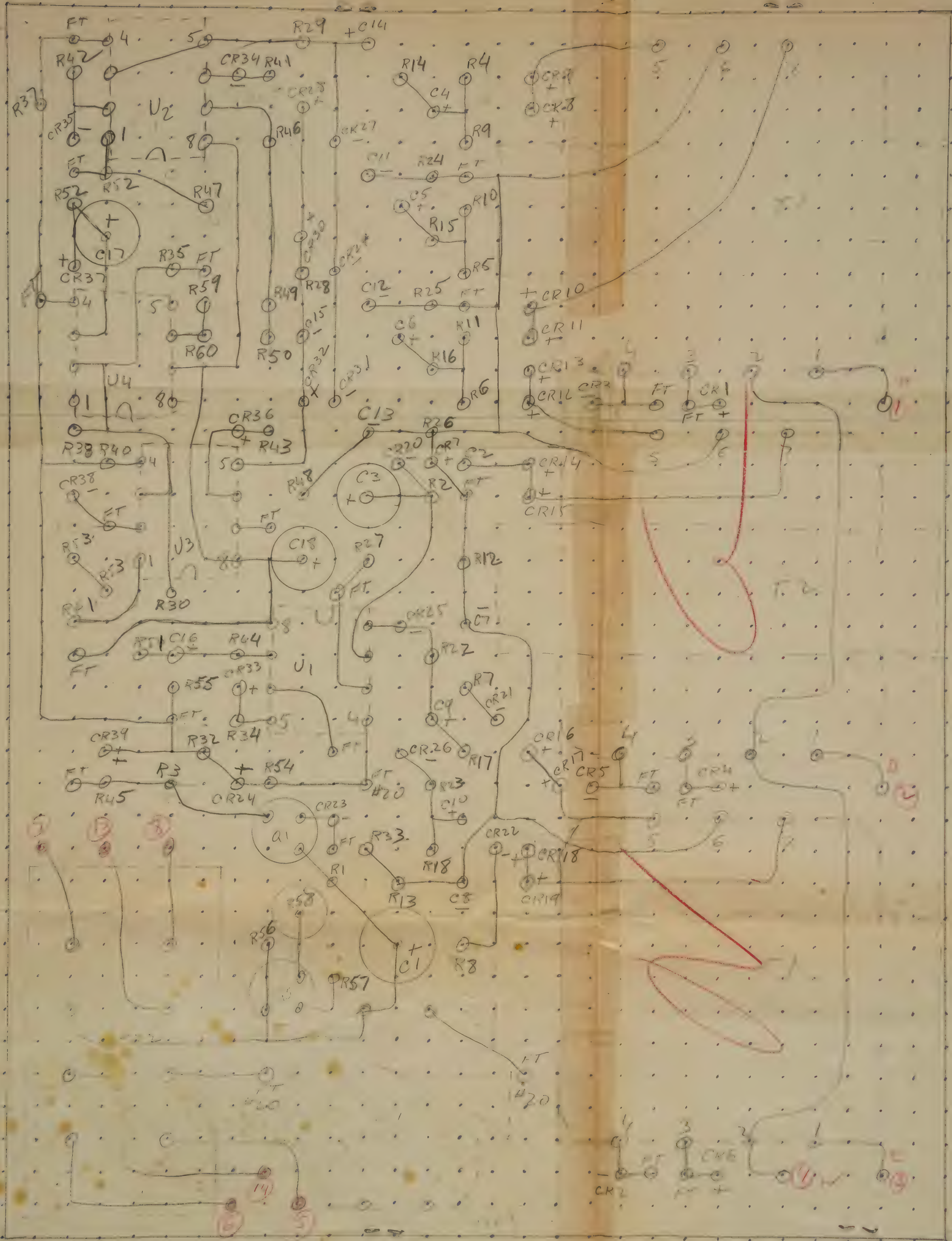
719710

SCALE NONE

MT: 1000 10

SHEET

1 OF 12

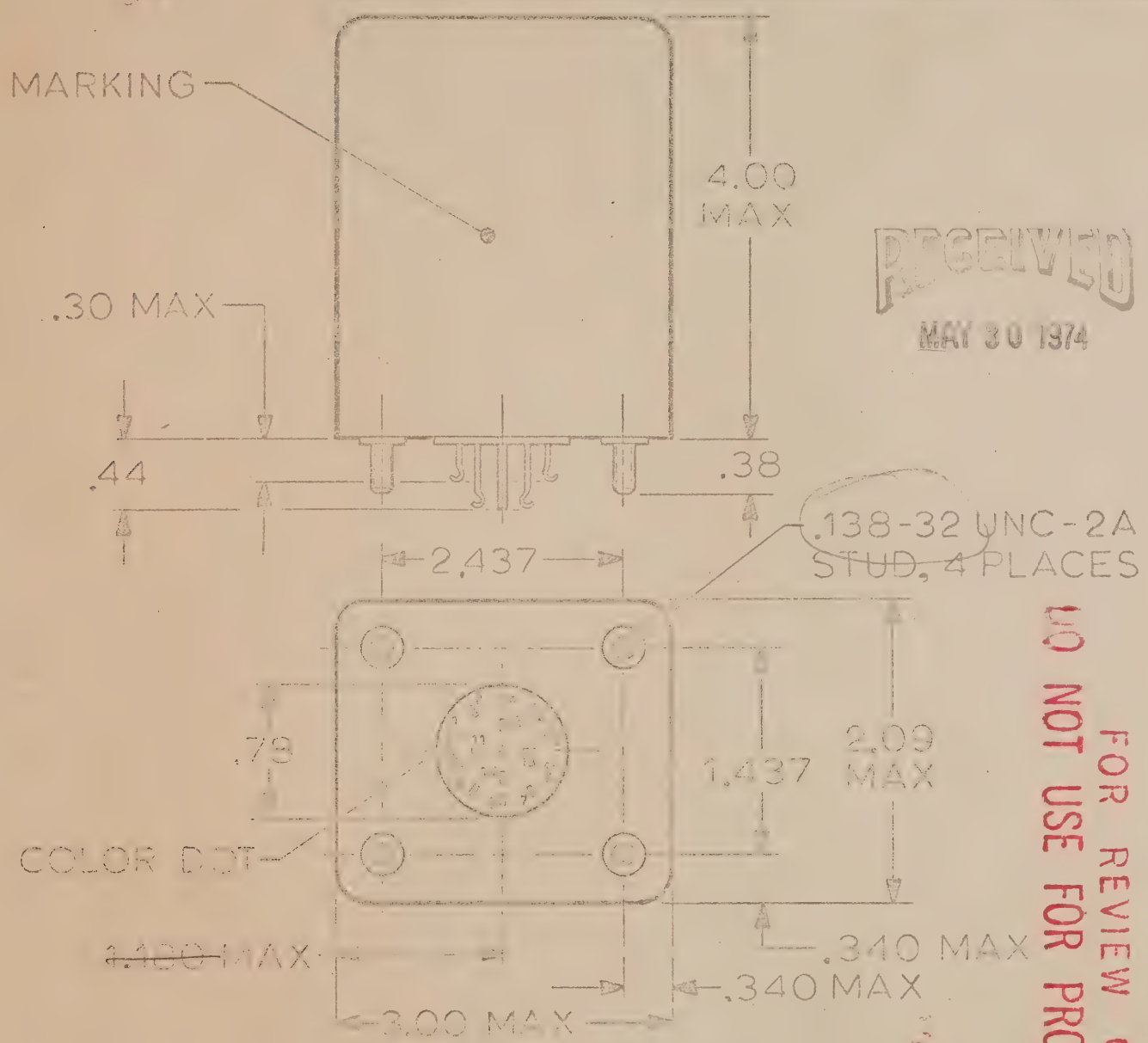


ALL
FT
AUG 22
EXCEPT
AS
NOTED
(3.20)

Unit 1 on 11

74-810

REVISIONS			
ITER	DESCRIPTION	DATE	APPROVED
-	SEE SHEET 11		



RECEIVED
MAY 30 1974

FOR REVIEW ONLY
DO NOT USE FOR PROCUREMENT

FIGURE 1: PHYSICAL DIMENSION SPECIFICATION CONTROL DRAWING

PREPARED IN ACCORDANCE WITH MIL-STD-100A
INTERPRET DRAWING IN ACCORDANCE WITH MIL-D-1000, CATEGORY F, FORM 1

EXCEPT AS NOTED
DIM. ARE IN INCHES
AND PER ANS Y14.5
.XXX .XX ANGLES
+.010 +.03 -
MATERIAL

DR
CHK

HUGHES

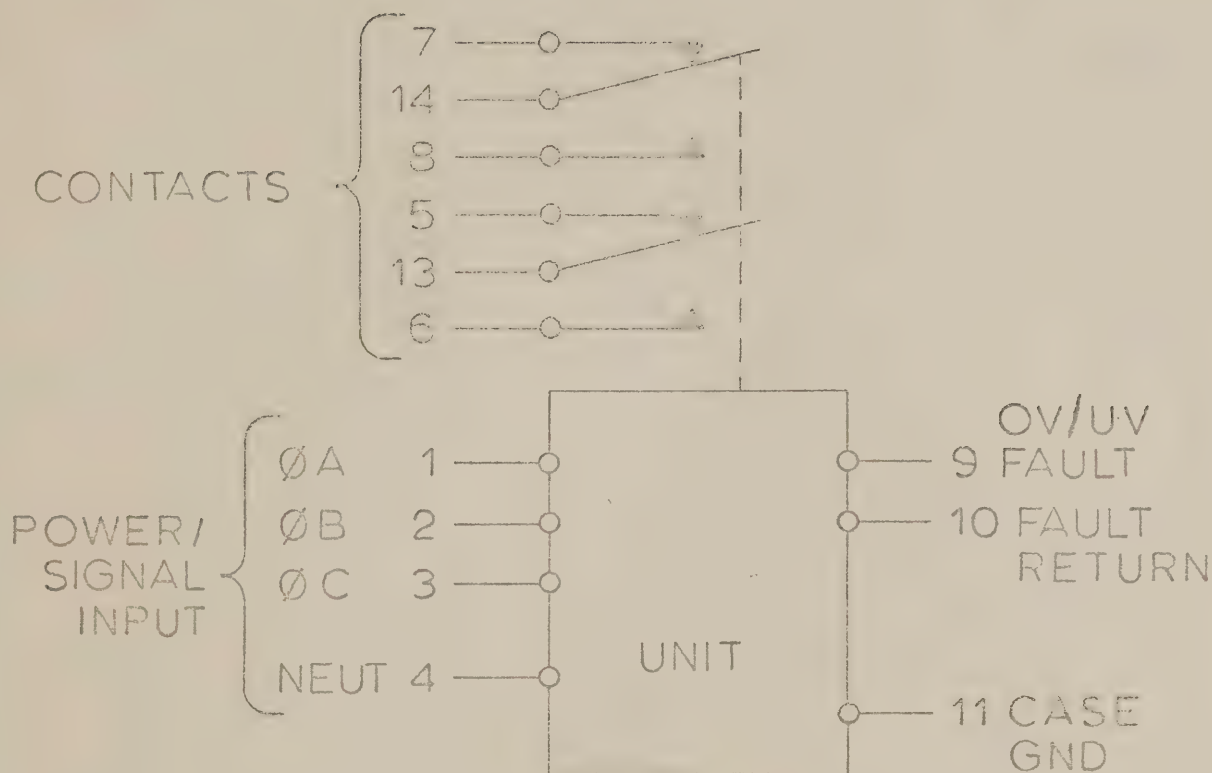
HUGHES AIRCRAFT COMPANY
FULLERTON, CALIFORNIA

RELAY, SENSING (OVER-UNDER VOLTAGE)

APPD

SIZE	COORDINATE NO.	DRAWING NO.	REV
A	05869	713710	-
SCALE	NONE	DT: NOTE 10	SHEET 1 OF 12

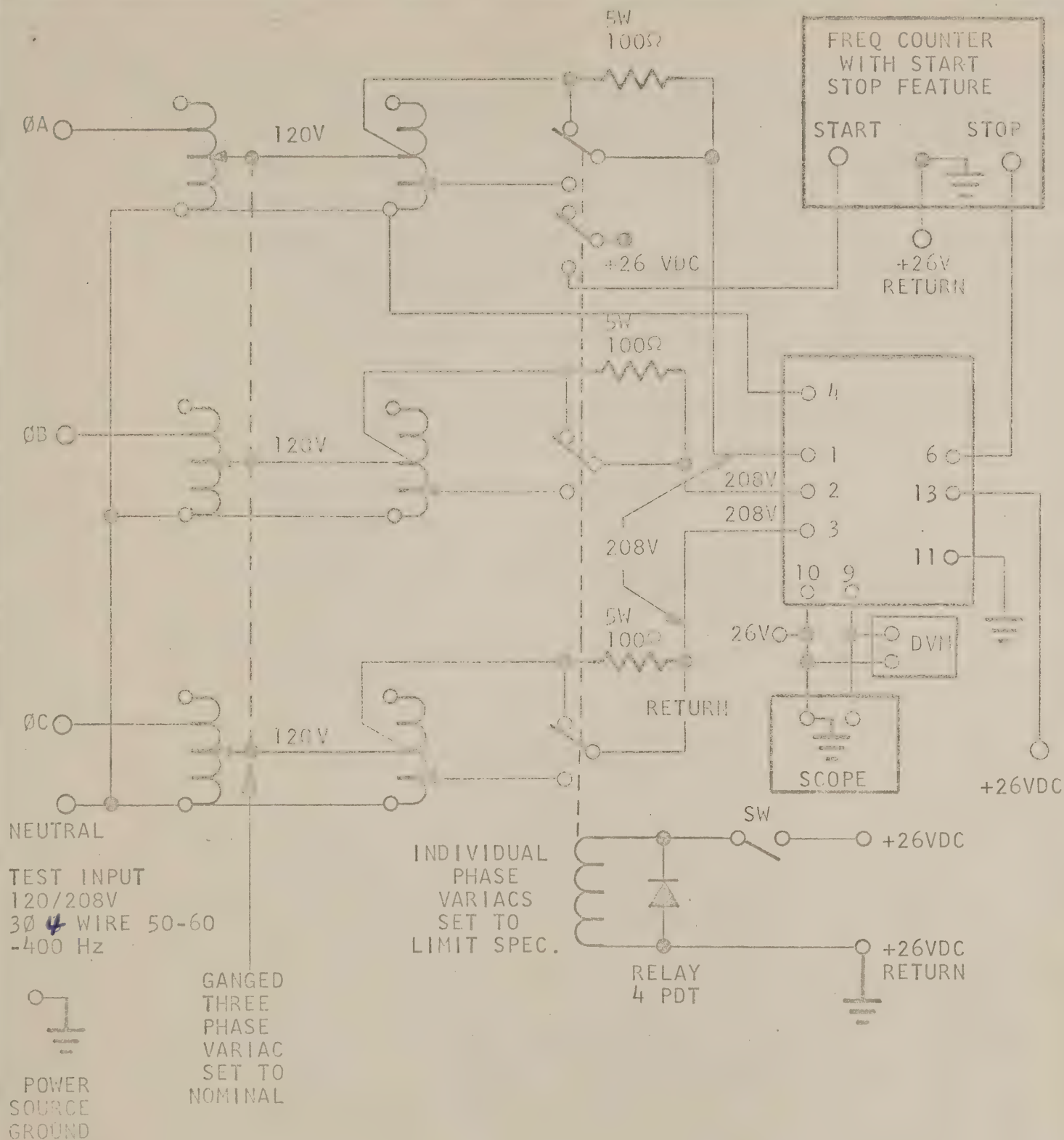
MEMORANDUM FOR THE RECORD



CIRCUIT DIAGRAM
UN-ENERGIZED POSITION

FIGURE 2

SIZE	CODE IDENT. NO.	REV
A	05869	719710
SCALE	NONE	SHEET 2



RECOMMENDED TEST SETUP FOR TIMING MEASUREMENT

FIGURE 3

SIZE	CODE IDENT. NO.	REV
A	05869	719710
SCALE NONE	SHEET	3

NOTES:

1. PARTS SUPPLIED TO THIS DOCUMENT SHALL MEET THE GENERAL REQUIREMENTS OF SPECIFICATION MIL-R-28750 AND AS SPECIFIED HEREIN.
2. THE RELAY SHALL MEET THE ELECTRICAL REQUIREMENTS WHEN OPERATED UNDER THE FOLLOWING CONDITIONS:
 - (A) POWER/SIGNAL VOLTAGE:
 - (1) 120/208 VAC NOMINAL, 3 PHASE, WYE CONNECTED (4 WIRE INPUT), PHASE SEQUENCE ABC.
 - (2) RANGE OF OPERATION: 0 TO 175 VAC, PHASE TO NEUTRAL.
 - (B) POWER/SIGNAL FREQUENCY:
 - (1) 50, 60, 400 Hz NOMINAL (POWER SOURCE FREQUENCY).
 - (2) RANGE OF OPERATION: 47.5 TO 420 Hz. —
 - (3) NO DAMAGE LIMIT: 45 TO 440 Hz.
 - (C) POWER/SIGNAL DISTORTION:
 - (1) TOTAL HARMONIC 5% MAXIMUM.
 - (2) INDIVIDUAL HARMONICS TO 7TH INCLUSIVE, EACH 3% MAXIMUM.
 - (D) POWER/SIGNAL MODULATION VOLTAGE INCLUDED IN NOMINAL OPERATION RANGE:
$$2\% \text{ MAXIMUM, } \%MOD = \frac{V_{MAX} - V_{MIN}}{V_{MAX} + V_{MIN}} \times 100$$
 - (E) POWER/SIGNAL INPUT IMPEDANCE:
1,000 OHMS MINIMUM EACH PHASE TO PHASE.
 - (F) OVER/UNDER VOLTAGE FAULT OUTPUT (ABBREVIATED, FAULT OUTPUT):
T²L COMPATIBLE WITH A CAPABILITY OF SUPPLYING AT LEAST 1.0 MILLIAMPERE AT 3.5 ± 1 VOLT FROM AN INTERNAL SOURCE IMPEDANCE OF 1,000 OHMS MAXIMUM. AT +0.5, -0, IT SHALL BE CAPABLE OF SINKING 10 MILLIAMPERES MINIMUM. THE MINIMUM PULSE WIDTH SHALL BE 3 MS.

SIZE	CODE IDENT. NO.		REV
A	05869	719710	-
SCALE	NONE	SHEET	1

(G) POWER/SIGNAL AND FAULT OUTPUT ISOLATION: §4

THE IMPEDANCE BETWEEN TERMINAL 10 AND 1, 2, 3 SHALL BE 50 K OHMS MINIMUM. THE RELAY CONTACTS SHALL BE ISOLATED FROM ALL VOLTAGE INPUT TERMINALS AND CASE. ALL TERMINALS SHALL ALSO BE ISOLATED FROM CASE BY 20 MEGOHMS MINIMUM, EXCEPT CASE GROUND.

(H) OPERATING POWER:

OPERATING POWER SHALL BE TAKEN FROM THE POWER/SIGNAL INPUT LINES.

(J) SIGNAL MONITORING:

ALL AC VOLTAGES ARE AVERAGE VALUES AS MEASURED BY AN RMS INDICATING, AVERAGE SENSING DIGITAL VOLTMETER OR EQUIVALENT.

3. VOLTAGE SENSING CHARACTERISTICS:

LIMIT 1: IF ANY PHASE OF THE NOMINAL INPUT VOLTAGE SHOULD INCREASE TO $129.5 +3, -1V$, THE OTHER TWO PHASES HELD AT NOMINAL VOLTAGE OR IF ALL PHASES SIMULTANEOUSLY OF THE NOMINAL INPUT VOLTAGE SHOULD INCREASE TO $129.5 \pm 1V$, THE RELAY SHALL TRIP BETWEEN 1.8 AND 2.2 SECONDS; HOWEVER, IF THE VOLTAGE SHOULD DROP BELOW 128.5 VOLTS BEFORE 1.8 SECONDS, THE RELAY SHALL NOT TRIP. AFTER TRIP, IF THE VOLTAGE SHOULD DECREASE, THE RESET DIFFERENTIAL VOLTAGE SHALL NOT EXCEED 2.0 VOLTS. THE RESET TIME SHALL NOT EXCEED 0.2 SECOND.

LIMIT 2: IF ANY PHASE OF THE INPUT VOLTAGE SHOULD INCREASE ABOVE $161 \pm 2V$, THE RELAY SHALL TRIP WITHIN 30 MS. AFTER TRIP IF THE VOLTAGE SHOULD DECREASE BELOW LIMIT 1, THE RELAY SHALL PULL IN.

LIMIT 3: IF ANY PHASE OF THE NOMINAL INPUT VOLTAGE SHOULD DECREASE TO 104.5 ± 2 VOLTS, THE OTHER TWO PHASES HELD AT NOMINAL VOLTAGE OR IF ALL PHASES SIMULTANEOUSLY OF THE NOMINAL INPUT VOLTAGE SHOULD DECREASE TO 104.5 ± 2 VOLTS, THE RELAY SHALL TRIP BETWEEN 4.5 AND 5.5 SECONDS. HOWEVER, IF THE VOLTAGE SHOULD INCREASE ABOVE 102.5 VOLTS BEFORE 4.5 SECONDS,

SIZE	CODE IDENT NO.	719710	REV
A	05869		-
SCALE	DATE	TEST	5

3. (CONTINUED)

LIMIT 3 (CONTINUED):

THE RELAY SHALL NOT TRIP. AFTER TRIP, IF THE VOLTAGE SHOULD INCREASE, THE RESET DIFFERENTIAL VOLTAGE SHALL NOT EXCEED 2.0 VOLTS. THE RESET TIME SHALL NOT EXCEED 0.2 SECONDS.

IF ALL PHASES SIMULTANEOUSLY SHOULD DECREASE TO 104.5 ± 2 V, THE FAULT OUTPUT SHALL BE -0, +.5 VOLTS. IF THE VOLTAGE SHOULD INCREASE BACK TO 105.5 VOLTS OR HIGHER, THE FAULT OUTPUT SHALL BE 3.5 ± 1 VOLT. THE RESET DIFFERENTIAL VOLTAGE SHALL NOT EXCEED 2.0 VOLTS. THE RELAY IN EITHER CASE SHALL NOT TRIP. THE RISE AND FALL TIME OF THE FAULT OUTPUT SHALL NOT EXCEED 0.1 MILLISECONDS, AND THE PULSE WIDTH SHALL NOT BE LESS THAN 3 MILLISECONDS.

IF ALL PHASES SIMULTANEOUSLY SHOULD DECREASE FROM NOMINAL TO 75 ± 5 VOLTS, THE DELAY TIME BETWEEN THE PASSING OF ANY ONE PHASE TO NEUTRAL INPUT THROUGH THE 104.5 ± 2 VOLTS REGION AND THE FAULT OUTPUT SHALL NOT BE GREATER THAN 6 MILLISECONDS AT 50 OR 60 Hz INPUT AND 1 MILLISECOND AT 400 Hz INPUT. IF ALL PHASES SIMULTANEOUSLY SHOULD INCREASE FROM 75 ± 5 VOLTS TO NOMINAL, THE DELAY TIME SHALL NOT BE GREATER THAN 2 MILLISECONDS.

LIMIT 4: THE SENSOR SHALL START TO OPERATE AND THE RELAY SHALL BECOME ENERGIZED WHEN THE THREE PHASE INPUT, FROM ZERO VOLTS, REACHES 90 VOLTS OR BEFORE. THE SENSOR SHALL CEASE TO OPERATE AT 45 VOLTS OR BELOW WHEN THE THREE PHASE NOMINAL INPUT IS REMOVED.

FAULT OUTPUT: IN ADDITION, A FAULT OUTPUT OF -0,+.5 VOLTS SHALL ALSO OCCUR WHENEVER THE LIMITS OF 1 AND 2 ARE EXCEEDED, TIMEWISE, TO OCCUR PRIOR TO THE OPENING OF THE CLOSED CONTACTS.

NO TRIP LIMIT: INPUT SIGNAL VARIATIONS OF A PULSE DURATION OF 100 μ SEC OR LESS, WHETHER IN OR OUT OF LIMITS 1, 2 OR 3, SHALL NOT CAUSE NUISANCE TRIP OR RESET OF RELAY, OR A FAULT OUTPUT.

SIZE	CODE IDENT. NO.		REV
A	05869	719710	-
SCALE	NONE	SHEET	6

3. (CONTINUED)

MISSING VOLTAGE: IF ANY ONE PHASE VOLTAGE IS NOT APPLIED OR REMOVED AFTER IT HAS BEEN APPLIED, THE OTHER TWO PHASES BEING CONTINUOUSLY APPLIED, CONTACTS 6 AND 13 SHALL REMAIN OR BECOME OPEN RESPECTIVELY. TRIP TIME SHALL BE NO GREATER THAN 0.2 SECONDS IF PHASE VOLTAGE IS APPLIED AND THEN REMOVED.

MONITORING TERMINALS: CONTACTS 5, 6 AND 13 SHALL BE MONITORED FOR THESE TESTS. CONTACTS 7, 8 AND 14 SHALL ONLY BE MONITORED WITH CONTACTS 5, 6 AND 13 DURING MISSING VOLTAGE TEST. TRIP TIME SHALL BE MONITORED AS THE OPENING OF CONTACTS 6 AND 13. SEE FIGURE 3.

NOMINAL OPERATION: CONTACTS 8 AND 14 AND 6 AND 13 SHALL BE CLOSED (HAVE CONTINUITY) WHEN 120 VOLTS $\pm 10\%$ AND 50, 60 OR 400 Hz $\pm 5\%$ ARE APPLIED TO THEIR APPROPRIATE TERMINALS.

4. TEST CONDITIONS: WITH A 3 \emptyset POWER SOURCE THAT WILL PROVIDE A VARIABLE VOLTAGE ON EACH PHASE TO NEUTRAL, APPLY 120 VOLTS $\pm 1\%$, 60 ± 3 Hz BETWEEN TERMINALS 1, 2, 3 AND 4 WITH TERMINAL 11 CONNECTED TO POWER SOURCE GROUND, TEST AS FOLLOWS:

LIMIT 1: INCREASE PHASE A VOLTAGE FROM NOMINAL TO 129.5 +3, -1 VOLTS AND RECORD THE TRIP TIME AND VOLTAGE. AFTER THE RELAY TRIPS, DECREASE PHASE A VOLTAGE TOWARD NOMINAL AND RECORD DIFFERENTIAL VOLTAGE AND RESET TIME. RECORD THE FAULT OUTPUT BEFORE AND AFTER THE RELAY TRIPS.

LIMIT 2: TRIP VOLTAGE - VARY PHASE A TO 161 ± 2 V AND RECORD TRIP VOLTAGE, REGARDLESS OF TRIP TIME. AFTER RELAY TRIPS, DECREASE PHASE A VOLTAGE TO NOMINAL. RECORD THE FAULT OUTPUT BEFORE AND AFTER THE REALY TRIPS.

TRIP TIME - VARY PHASE A RAPIDLY THROUGH THE 161 ± 2 V REGION TO 170 ± 2 V AND RECORD TRIP TIME. AFTER RELAY TRIPS, DECREASE PHASE A VOLTAGE BELOW 128.5V.

SIZE	CODE IDENT. NO.		REV
A	05869	719710	-
SCALE	NONE	SHEET	7

4. (CONTINUED)

LIMIT 3: TRIP VOLTAGE - DECREASE ALL THREE PHASES SLOWLY FROM NOMINAL JUST PASS 104.5 ± 2 VOLTS AND RECORD THE TRIP VOLTAGE WHERE THE FAULT OUTPUT CHANGES FROM 3.5 ± 1 VOLT TO -0, +0.5 VOLTS. ALSO RECORD THE FAULT OUTPUT PULSE WIDTH AND FALL TIME. STARTING FROM 75 ± 5 VOLTS, INCREASE ALL THREE PHASES SLOWLY JUST PAST 104.5 ± 2 VOLTS AND RECORD THE TRIP VOLTAGE WHERE THE FAULT OUTPUT CHANGES FROM -0, +0.5 VOLTS TO 3.5 ± 1 VOLT. ALSO RECORD THE FAULT OUTPUT PULSE WIDTH AND RISE TIME.

TRIP TIME - DECREASE ALL PHASES SIMULTANEOUSLY FROM NOMINAL, VERY RAPIDLY THROUGH THE 104.5 ± 2 VOLT REGION TO 75 ± 5 VOLTS AND RECORD THE DELAY TIME BETWEEN THE PASSING OF ANY ONE PHASE TO ~~PHASE~~ ^{NEUTRAL} INPUT THROUGH THE 104.5 ± 2 VOLT REGION AND THE FAULT OUTPUT. INCREASE ALL PHASES SIMULTANEOUSLY FROM 75 ± 5 VOLTS VERY RAPIDLY THROUGH THE 104.5 ± 2 VOLT REGION TO NOMINAL AND RECORD THE DELAY TIME.

LIMIT 4: INCREASE THE THREE PHASE VOLTAGE FROM ZERO VOLTS TO NOMINAL AND RECORD THE TRIP VOLTAGE WHERE THE RELAY BECOMES ENERGIZED. DECREASE THE THREE PHASE VOLTAGE FROM NOMINAL TO ZERO VOLTS AND RECORD THE TRIP VOLTAGE WHERE THE RELAY DE-ENERGIZES.

REPEAT LIMIT 1 EXCEPT VARY PHASE B. REPEAT AGAIN EXCEPT VARY PHASE C. REPEAT LIMIT 1 FOR ALL THREE PHASES SIMULTANEOUSLY EXCEPT VARY TO 129.5 ± 1 VOLT.

REPEAT LIMIT 3 EXCEPT APPLY $400 \text{ Hz} \pm 20 \text{ Hz}$ TO INPUT.

5. DURING THE CHARACTERISTIC VOLTAGE SENSING TESTS, THE RELAY SHALL TRIP AND RESET IN THE SPECIFIED TIME AND AT THE SPECIFIED VOLTAGE. THE FAULT OUTPUT SHALL PERFORM AS SPECIFIED.

SIZE	CODE IDENT. NO.		REV
A	05869	719710	-
SCALE	NONE	SHEET	3

6. DIELECTRIC WITHSTANDING VOLTAGE: PER MIL-R-28750 EXCEPT THE VOLTAGE AMPLITUDE SHALL BE 1000 V RMS, 60 Hz BETWEEN PINS AND CASE.

7. INSULATION RESISTANCE: PER MIL-R-28750.

8. ENVIRONMENTAL REQUIREMENTS:

OPERATING TEMPERATURE: 0°C TO +71°C

STORAGE TEMPERATURE: -20°C TO +85°C

VIBRATION: PER MIL-R-28750 EXCEPT THE AMPLITUDE AND FREQUENCY SHALL BE 10 G'S, 10 TO 500 Hz.

SHOCK: PER MIL-R-28750, 100 G'S, 6 MS DURATION.

THERMAL SHOCK: PER MIL-R-28750.

MOISTURE RESISTANCE: PER MIL-R-28750.

SALT SPRAY: PER MIL-R-28750.

ENDURANCE PER MIL-R-28750 EXCEPT THAT ONLY 50,000 OPERATIONS SHALL BE PERFORMED. A CYCLE IN THIS LIFE TEST IS DEFINED AS FOLLOWS:

APPLY $120 \pm 1\%$, 60 ± 3 Hz BETWEEN TERMINALS 1, 2, 3 AND 4 INCREASE THE VOLTAGE TO 135 VOLTS FOR 10 SECONDS. DECREASE TO 120 VOLTS FOR 20 SECONDS THEN DECREASE THE VOLTAGE TO 100 VOLTS FOR 10 SECONDS, INCREASE THE VOLTAGE TO 120 VOLTS FOR 20 SECONDS. THE CONTACT LOAD SHALL BE 5 AMPERES RESISTIVE AT 28 VDC AND THE TEMPERATURE SHALL BE +71°C. AFTER LIFE, PERFORM INSULATION RESISTANCE, DIELECTRIC WITHSTANDING VOLTAGE, CONTACT RESISTANCE AND THE OPERATING CHARACTERISTIC TESTS. AFTER LIFE THE CONTACT VOLTAGE DROP SHALL NOT EXCEED 200 mV.

9. RELAY USED INTERNALLY SHALL MEET ALL REQUIREMENTS OF THIS SPECIFICATION.

10. MECHANICAL REQUIREMENTS:

WEIGHT _____ 20 OUNCES MAXIMUM

TERMINALS _____ SOLDER HOOK, SUITABLY THREADED TO FACILITATE SOLDERING

MOUNTING ATTITUDE _____ THE RELAY SHALL MEET ALL REQUIREMENTS WHEN MOUNTED IN ANY POSITION.

SIZE	CODE IDENT. NO.		REV
A	05869	719710	-
SCALE	NONE	SHEET	9

11. MARKING. EACH RELAY SHALL BE PERMANENTLY AND LEGIBLY MARKED WITH THE FOLLOWING INFORMATION IN ACCORDANCE WITH MIL-STD-130:

- (A) THE HUGHES-FULLERTON PART IDENT NUMBER
- (B) MANUFACTURER'S NAME OR SYMBOL AND PART NUMBER
- (C) EIA DATE CODE
- (D) TERMINAL IDENTIFICATION
- (E) CIRCUIT DIAGRAM

TABLE I - RELAY REQUIREMENTS

HUGHES PART IDENT NUMBER	CONTACT ARRANGEMENT	CONTACT RATING AT 28 VDC OR 115 VAC		CONTACT BOUNCE MAXIMUM
		RESISTIVE	INDUCTIVE	
719710-1	DPDT	5 AMPS	2 AMPS	2 MILLISECONDS

SIZE A	CODE IDENT. NO. 05869	719710	REV -
SCALE NONE		SHEET 10	

DESCRIPTION

APPROVED

RELEASED

CODE IDENT. NO.

05869

719710

REV

SCALE NONE

SHEET

117

HUGHES IDENT NUMBER	SUPPLIER PART NUMBERS		
	PARKO ELECTRONICS		
719710-1	101280		

SUGGESTED SOURCE(S) OF SUPPLY:

PARKO ELECTRONICS INC., SANTA ANA, CALIF. FSCM 13979

SIZE A	CODE IDENT. NO. 05869	719710	REV -
SCALE NONE		SHEET 12	

